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ANNALS *of* SURGERY

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MANAGEMENT OF INJURIES TO THE CRANIUM AND ITS CONTENTS*

WITH SPECIAL REFERENCE TO CEREBROSPINAL FLUID PRESSURE DETERMINATIONS

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SINCE Kocher¹ and then Cushing² demonstrated the sequence of events which follow increased intracranial pressure on the medulla, there have been more accurate interpretations of the degree of bulbar compression. The

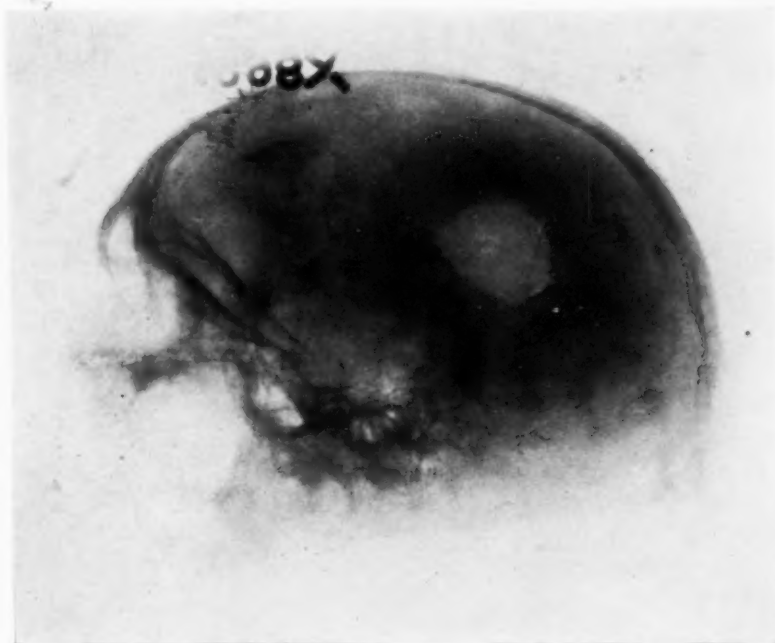


FIG. 1.—Case I, Private B. Compound comminuted depressed fracture with extra-dural hemorrhage.

local examination of patients with suspected intracranial injury, usually plays only a small part in determining whether or not immediate operation is indicated. A contusion with resultant swelling of the soft parts, a forceful

* Read before the Philadelphia County Medical Society, October 12, 1921.

separation of the temporal or occipitofrontalis muscle from the skull, at times precludes determining by palpation the exact bony pathology present; frequently the X-ray helps but little; if the bone lesion is extensive we do not need it, and if it is slight the röntgenographic evidence is no criterion to the degree of intracranial pathology.

Lecount and Apfelbach,⁶ in a study of 504 cases of skull fracture, found that 85 per cent. had a simple linear fracture; yet 94 per cent. of the brains of these individuals at operation or post-mortem, showed laceration or contusion. We should usually depend therefore on the result of a general



FIG. 2.—Case I, Private B. Scar following debridement.

examination to guide us, especially symptoms from interference with circulation in the medulla. More attention has been paid to the study of the gross changes found at autopsy than to the pathologic physiology which accompanies the early or ante-mortem changes.

The pathologists say that the most frequent change in brains of patients dying from skull fracture is traumatic œdema, but this in itself is only partially enlightening. An injury which interferes with the nutrition of cerebral substance, whether it is a contusion, laceration or an extradural pressure, results in a passage of fluid into the substance with subsequent swelling and the "rigid enclosure" of the brain may finally produce a bulbar anæmia.

As the intracranial space is encroached upon in the early stages of bulbar compression, the cerebrospinal fluid is forced out of the cranial vault, then the blood in the veins and finally the blood in the capillaries, arterioles and arteries.

MANAGEMENT OF INJURIES TO THE CRANIUM

During the process of evacuation of the spinal fluid and venous blood, no symptoms of any importance present themselves. Probably the eye-grounds during this stage would reveal changes of marked significance were they examined at frequent intervals. Just as soon, however, as the intracranial pressure becomes sufficiently high to force the blood out of the capillaries in the medulla, the stage of compensation Kocher describes begins; the vital centres suffer from the lack of oxygenated blood and the compensating mechanism increases the volume of air intake and raises the arterial tension.

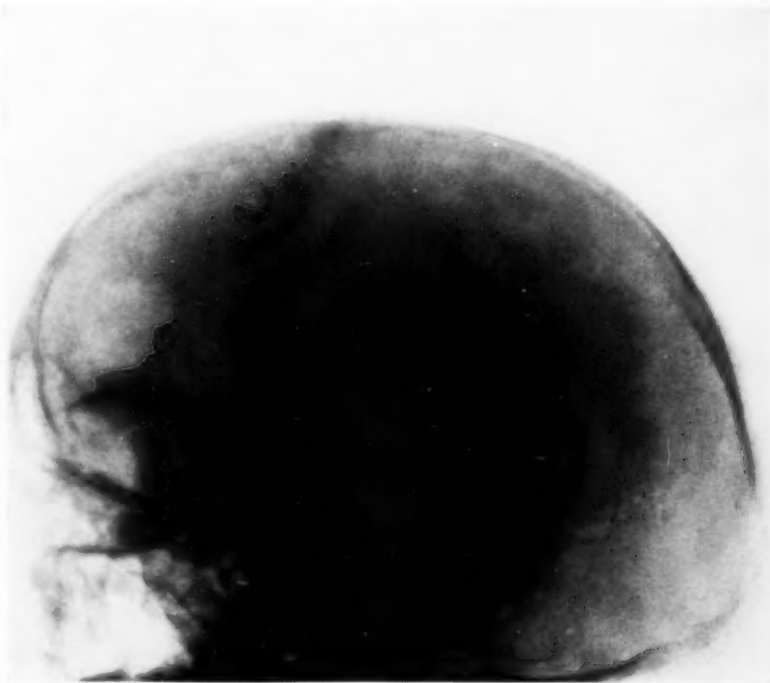


FIG. 3.—Case II, F. W. Extensive laceration of right frontoparietal region with fracture and depression of inner table of frontal bone.

These are the changes which take place, generally, in the average case. It must be realized, however, that the degree of involvement of the vital centres depends on the severity and the situation of the cranial injury. In a fair percentage of head cases the damage to these centres has been so great that the patient does not react to shock and again there may be a localized area of brain entirely destroyed with no perceptible change in the protecting mechanism situated below the tentorium.

In one patient, who came under my observation, a man who was struck by an automobile and thrown against an electric light pole, a disc of bone about 1.5 cm. in diameter was driven directly into the speech centre; other than the slightly lacerated and contused scalp and aphasia, this patient presented no evidence of an intracranial involvement.

In these two types of cases the interpretation of the changes that take place in the medulla is not vital. The treatment is definite. Where the

patient reacts from shock, however, and passes into the stage of compensation the changes in the cerebrospinal fluid pressure, blood pressure, pulse and respiration must be accurately noted so that at any moment these readings may be converted into terms of medullary circulation.

Of secondary consideration, especially with reference to localization, are paralysis, ocular changes, increased, absent or diminished superficial and deep reflexes.

Cerebrospinal Pressure.—Much has been written about the advisability of doing lumbar puncture in the presence of increased intracranial tension. Cushing states that it is dangerous and that he has seen death follow the



FIG. 4.—Case II, F. W. Scar following debridement and decompression.

procedure. Sachs makes a similar statement. Frazier² believes that lumbar puncture is essential. Sharpe⁹ advocates the use of the spinal manometer but states that "as a rule not more than 5 c.c. of cerebrospinal fluid should be removed at lumbar puncture for diagnostic purposes and no therapeutic attempt made to lessen the intracranial pressure if the ophthalmoscopic and spinal manometric tests have disclosed a high intracranial pressure." He reports three deaths in over sixteen hundred lumbar punctures. "In each case the lumbar puncture was performed by an inexperienced interne who held the erroneous belief that the purpose of the puncture was to remove as much of the cerebrospinal fluid as possible; two of these patients have had an intracranial tumor, one being subtentorial and the third having the condition of internal hydrocephalus." At the Samaritan Hospital, it has been

MANAGEMENT OF INJURIES TO THE CRANIUM

done routinely for seven years. There have been no deaths and I believe there is little or no risk to the patient, if a needle with a three-way stop-cock is used. If one has had any experience, a puncture may be done without losing more than a drop or two of cerebrospinal fluid. It would be dangerous to a patient to place him in an upright position, insert a spinal needle and permit the fluid to spurt out, inducing shock by removing the buffer between the skull and the medulla; but if the patient is in the lateral prone position and a needle with a stop-cock is used, this danger is entirely eliminated. The force with which the cerebrospinal fluid is ejected from the needle, in some

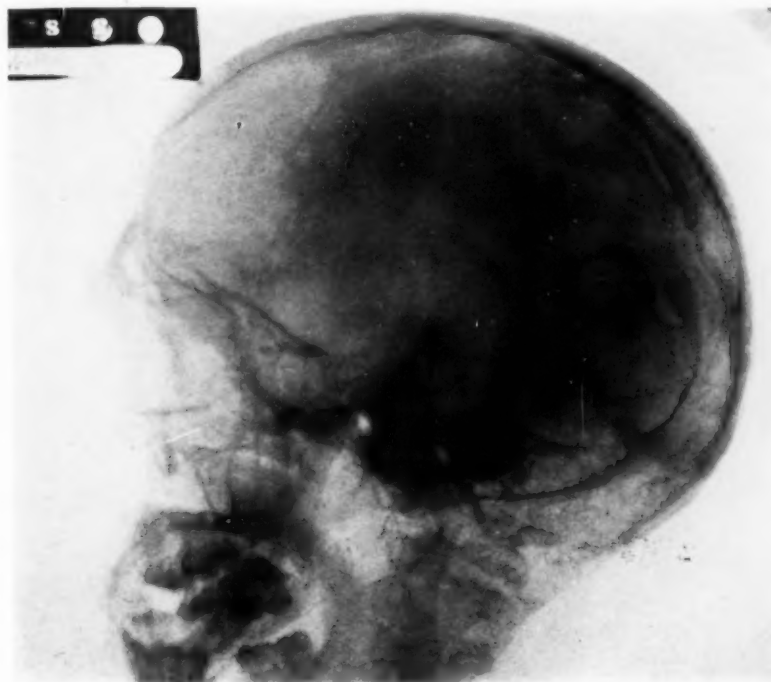


FIG. 5.—Case III, McC. Compound comminuted depressed fracture of right frontotemporal region associated with marked cerebral contusion.

cases, is no criterion of the degree of pressure within. On two occasions different surgeons of wide experience in doing lumbar puncture remarked upon the apparent lack of pressure, when observing the procedure, and were surprised to find that when the spinal manometer was attached the pressure was exceedingly high. Landon⁷ states that the normal cerebrospinal fluid pressure in the lateral prone position is four to eight mm. of mercury and in the upright position fifteen to twenty. Skogg⁸ states that a minimum figure can be placed at 90 and a maximum figure at 150 mm. water manometer (7 and 11 mm. of mercury). He does not mention, however, the position of the patient, or in which interspace the needle was inserted.

In several hundred observations we have found that the patient with a systolic blood-pressure of about 120 mm. of mercury and a diastolic of 85,

more frequently registers 4 mm. of pressure in the lateral prone and 12 to 16 in the upright position, when the needle is inserted into the second lumbar interspace. Inasmuch as the hydrostatic pressure is a contributing factor in the production of the pressure, the interspace selected and the position of the patient very definitely modify the pressure findings.

What degree of cerebrospinal pressure is abnormal? The presence of macroscopic blood in the cerebrospinal fluid and a pressure of 12 mm. of mercury in the lateral prone position should be considered sufficiently abnormal to require a reading every four hours. If the second reading shows that



FIG. 6.—Case III. McC. Defect following debridement and decompression.

the pressure has increased, enough fluid may be withdrawn to reduce the pressure to ten or twelve millimetres of mercury. If after eight hours there is an increase to twenty mm. or over and no improvement is noted, operation is indicated.

Blood-pressure.—Cushing² has emphasized the importance of blood-pressure readings in intracranial injury. It is being done more frequently and in most hospitals it is part of the routine examination of every head case. A point that I wish to call attention to, because it may be misleading and is also frequently overlooked, is the variation of the systolic and diastolic pressures in certain cases where the vital centres are laboring under considerable difficulty; one reading may show a systolic pressure of 160 and a diastolic of 100, another, within an hour, or within a few minutes, may show a drop

MANAGEMENT OF INJURIES TO THE CRANIUM

to a systolic of 120 and a diastolic of 50. These patients usually need prompt operative interference if they are to be saved. Occasionally a patient with a fractured skull and an associated heart lesion is observed, who, under normal conditions, has a very high blood-pressure. Recently such a case was brought to the hospital with a systolic pressure of 190 and a diastolic of 40 mm. of mercury, with symptoms of increased intracranial pressure; her cerebrospinal fluid pressure was 11 mm. of mercury in the lateral prone position. The fluid was clear, so the operation was deferred. In this case after 2 c.c. of cerebrospinal fluid were withdrawn the blood-pressure fell 20 mm. of



FIG. 7.—Case IV, M. S. Scars three months after debridement in frontotemporal region; fracture of middle and anterior fossa with moderate cerebral contusion.

mercury. Within twelve hours the blood-pressure had regained ten points and at the end of twenty-four it had returned to 180 mm.

While we have found that increased blood-pressure frequently accompanies increased intracranial pressure, they are not always associated. From examinations of over two hundred patients who were subjected to spinal anaesthesia, I found that there was no constant direct relation between the cerebrospinal pressure and the blood-pressure, which confirms the observations of others.

Respiration and Pulse.—The superficial breathing of the shocked patient, the slow, full or deep respiratory movements of one who is compensating from cerebral compression, and the Cheyne-Stokes' breathing of the non-compensating are familiar and the significance of each is apparent. What may be

said of inspection as to respiration may be said of palpation as to the pulse, there is the weak, rapid pulse in the shocked, the slow, full pulse of the compensating and the weak racing pulse of the paralyzed medulla. A slow, full pulse is indicative of increased intracranial pressure, but the slowness of pulse rate is not always commensurate with the degree of cerebral tension.

Watchful Waiting Cases.—A full appreciation, then, of the four cardinal points mentioned is sufficient to determine whether or not a case is an operative or a "watchful waiting" one. If immediate operation is indicated, the finer points relative to physical findings are not necessary. One does not need



FIG. 8.—Case V, E. B. Traumatic thrombosis of the cavernous sinus with probable cerebral contusion, photograph shows exophthalmus and almost complete disappearance of cicatrix six months after operation for defect.

an ophthalmoscopic examination to see that a decompression is essential if hemiplegia is present, the pulse 48, the blood-pressure 180 and 70, and the cerebrospinal pressure in the lateral prone position at the second lumbar interspace 30 mm. of mercury.

Undoubtedly examinations of the eye-grounds are essential but such examinations may be reserved for the "watchful waiting" cases, and by this I mean cases of suspected fracture of the skull in which the surgeon decided after the usual routine examination that operation is not immediately indicated. These should be watched personally until they are clearly clean-cut operative or decidedly non-operative. There should be half-hourly charting of the pulse and blood-pressure; hourly examination of the pupillary reactions, deep and superficial reflexes, noting increase or decrease in voluntary move-

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ments, etc. In the meantime the oculist should be consulted and the result of this examination charted. After four hours, if the indications for operation are still not definite, another spinal puncture should be made and the pressure taken. If the cerebrospinal pressure at the initial examination was above normal, and enough fluid was withdrawn to reduce the pressure to 10 mm. of mercury in the lateral prone position, then, at the second examination, an increase beyond the initial reading was observed, a decompression should be done despite the fact that there may be slight signs of improvement, *e.g.*, if after four hours there has been a partial return of voluntary movement, but unconsciousness persists. I am convinced that if such a routine procedure is followed there will be very few of the so-called borderline cases.

Realizing that a universal human tendency is to object to detail and that most of our errors could be traced to omissions on the part of the initial examiner, we have instituted the use of an examination card, outlining the essentials with sufficient space to register repeated examinations.

Importance of Accurate History.—While it is difficult and, at times, impossible to obtain an accurate history, an effort should be made to do so. On two different occasions in my recent experience a patient's life could have been saved, in all probability, had this principle been adhered to.

The following points are of prime importance:

1. To determine whether there has been a previous period of lucidity.
2. If there have been previous operations on the cranium or on parts innervated by cranial nerves.
3. If the patient has previously been subjected to epileptiform or other convulsive seizures.

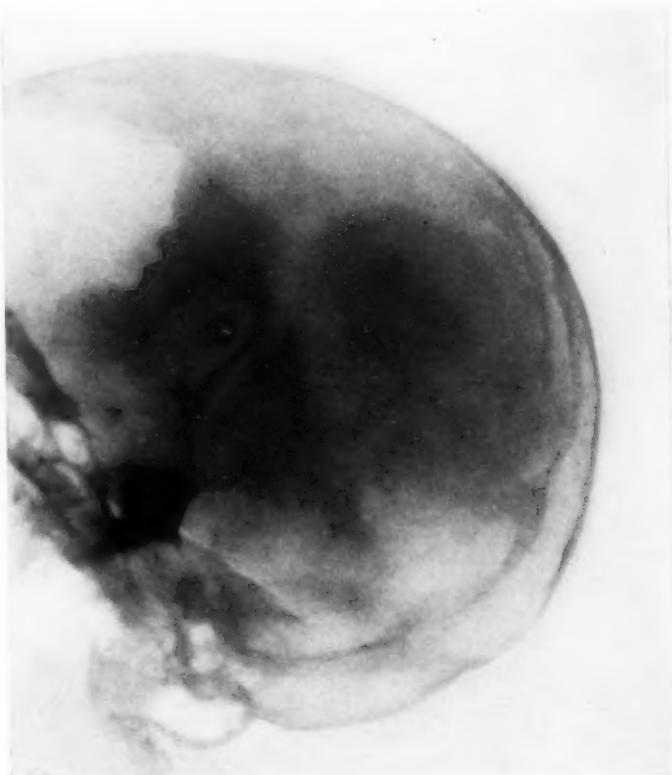


FIG. 9.—Case V. E. B. Defect following frontotemporal decompression.



FIG. 10.—Case V, E. B. Shows osteogenesis three months after autogenous transplant.



FIG. 11.—Case V, E. B. Shows osteogenesis eleven months after autogenous transplant.

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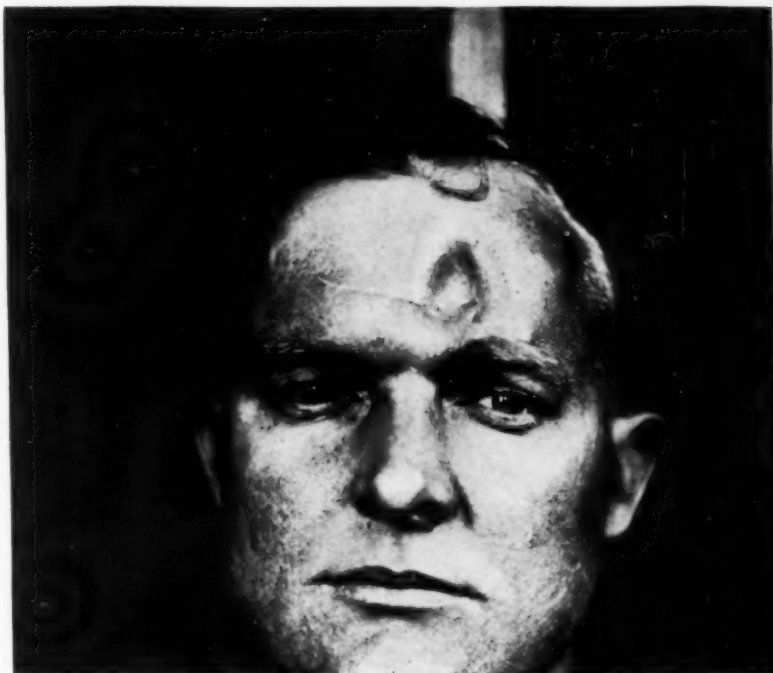


FIG. 12.—Case VI, Lt. B. H. Defect before operation.



FIG. 13.—Case VI, Lt. B. H. Defect after operation.

Preparation.—After the head has been shaved and the scalp cleansed with green soap, alcohol and ether, it is painted with tincture of iodine. Anæsthetic: Novocaine 1 per cent. with adrenalin is used locally, unless the patient is semi-conscious, restless and difficult to restrain, when ether is substituted. If debridement is not necessary, novocaine, either alone or in conjunction with ether, is employed. One can readily see the necessity for caution in using a local anæsthetic where the tissues are devitalized and con-



FIG. 14.—Case VII. Sergeant H. Shows bone defect mid-vertex.

taminated. The needle should be introduced at least 3 cm. away from the contaminated area.

Decompression with Debridement.—The major indication for operative interference in all cases of head injury is increased intracranial pressure; the minor, the presence of devitalized and contaminated tissues. After the removal of the devitalized parts, gloves and instruments should be changed. The incision can then be extended as the condition warrants. A subtemporal decompression should be done unless there is evidence of definite localization elsewhere.

When Should the Dura be Opened?—A non-pulsating dura should always be opened if there is other evidence of increased subdural pressure, but if the lesion involves the scalp and bone with comminution and depression of the latter and the coverings of the brain are intact, or if an extradural hemorrhage

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is present, the dura should not be opened unless there is a marked rise in blood-pressure and blood in the cerebrospinal fluid with marked increase in intraspinal pressure. Debridement cannot remove every vestige of infection, so one is not justified in opening the dura for exploratory purposes in its presence. The possibility of meningitis or encephalitis increases from less than five per cent. in the unopened cases to from fifteen to twenty-five per cent. in the opened ones. It is important in this connection also to remember the additional shock incident to such procedure. Where debridement has been done, primary union followed in every instance. This is a decided improve-



FIG. 15.—Case VII, Sergeant H. One month after operation. Note absorption around edge of defect.

ment over the technic used in pre-war days when a drain was inserted in cases of a doubtful nature. Debridement of brain tissue in this series of cases has been infrequent. Fracture of the base and vault, associated with massive cerebral contusion, frequently require prompt operative interference despite the fact that blood and cerebrospinal fluid escape from the nose or external auditory meatus or both, lessening to a limited degree the possibility of bulbar anemia.

When the scalp is intact or only moderately contused, Babcock's ⁵ post-mortem coronal incision may be used to advantage. It is not much longer than the elliptical one employed in doing a subtemporal decompression and has the advantage of permitting exposure of the opposite side if the condition warrants.

Post-operative Management.—For shock an enema consisting of coffee is usually given; if the shock is profound, intravenous injection of Fischer's solution with adrenalin may be used, followed by caffein and strychnine, hypodermatically. Mental irritability and restlessness tries the patience of the attendants and the resourcefulness of the surgeon in charge. Chloral hydrate grains xx; sodium bromide grains xl in four fluid ounces of water per rectum is at times helpful. Frequently it is necessary to resort to morphia. In forty-eight hours the dressing is changed and the alternate sutures

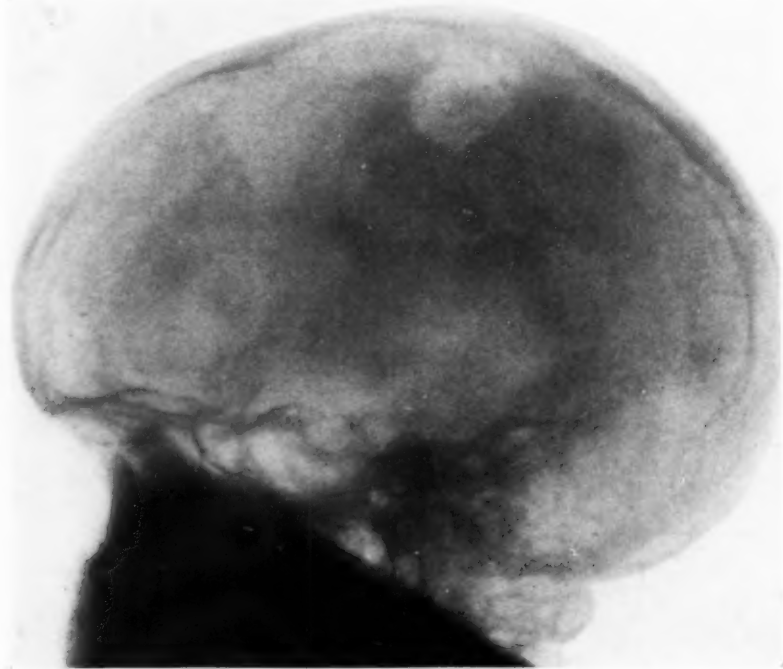


FIG. 16.—Case VII, Sergeant H. Defect showing active osteogenesis three months later.

removed; a boric-alcohol dressing is reapplied on the fourth and again on the sixth day, when the remaining sutures are taken out.

Treatment of Non-operative Cases.—In addition to the treatment for shock outlined above, external heat, bandaging the extremities and, at times, transfusion may be resorted to. As soon as the shock subsides the patient is placed in the Fowler position; the head is shaved and painted with tincture of iodine. There is some question regarding the proper method of treatment of the leakage of blood and cerebrospinal fluid from the ears and nose. It is sufficient to thoroughly cleanse the external parts. Probing and douching of the naris and auditory canals are entirely unnecessary. We have had no cases of meningitis develop when this treatment has been followed. The question of the duration of absolute rest in both the operative and non-operative cases is important. There is a tendency to permit mental and physical activity much too soon.

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FIG. 17.—Case VII, Sergeant H. Defect before operation.



FIG. 18.—Case VII, Sergeant H. Defect after operation.

JOHN O. BOWER

REOPERATION FOR DEFECT

Symptoms.—A period of at least three months should elapse between the first and second operation. The symptoms resulting from the defect in the skull are less severe in patients in civil than in military practice. The most important are fear of injury to the brain, vertigo, which usually occurs when the patient suddenly changes position, cephalalgia, pulsations and Jacksonian convulsions.

Pre-operative Management.—In overseas cases we studied the blood and cerebrospinal fluid cytologically and noted the blood and cerebrospinal fluid



FIG. 19.—Case VIII, Private S. Defect right frontal.

pressure before operation, in order that we might have a standard of comparison should complications arise during the immediate post-operative period. (See Case VI.) Urotropin 30 grs. in divided doses was given for several days preceding and for the first three or four days following operation. The scalp was shaved twenty-four hours prior to the operation and painted with tincture of iodine.

Anæsthesia.—I have tried novocaine with adrenalin, locally, combined local and narcotic and ether, and I believe that ether is the best anæsthetic for these cases. The removal of the external table adds exceedingly to the degree of shock, if the patient is conscious or semi-conscious. True, one may add sufficient narcotic to produce unconsciousness, but morphine and scopolamine with or without apomorphia masks shock. I have had two deaths follow

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prolonged operations on the head (not for defect) which would have been done in two stages had not the patients' real condition been masked by the narcotic, the full pulse of narcosis giving a false sense of security.

In contemplating the incision, the main points to be considered are:

1. A flap large enough to include the defect and the area of the skull from which the graft is to be removed.
 2. Separation of the flap, including the cicatrix, without opening the dura.
- (This presupposes, of course, that there is no intracranial complication.)

The large flap makes the separation of the scar over the defect much

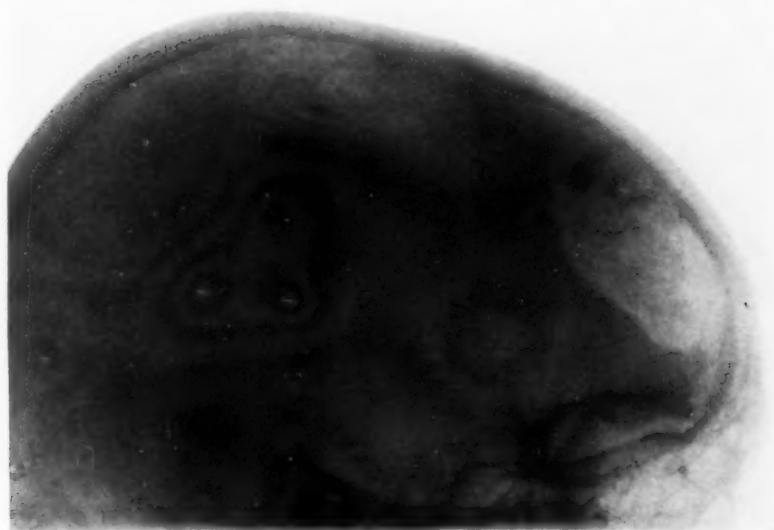


FIG. 20.—Case VIII, Private S. Transplant two months later. Note absorption of edge of defect.

easier; if the scar is unsightly, or there is any question regarding its viability, it can be removed just before the flap is sutured back in position. I know of one overseas case in which death occurred from opening the dura when the scar-tissue harbored an old infection that became active, resulting in encephalitis of quick termination. Had the two principles been adhered to, the infection, in all probability, would have resulted only in a local meningitis. I re-operated on such a case. An alien bone graft had been inserted, a local meningitis developed in three days at which time the graft was removed. The wound healed in two weeks; subsequent operation for defect was refused.

Technic.—Using a sharp knife, the pericranium is divided about 1 cm. from the edge of the defect and reflected inward, the dura is then separated from the inner table, using a blunt dural separator; the edge of the defect

is roughened with a small rongeur; a rubber drain patterned after the defect is placed over the intact area of the skull. With a sharp knife the pericranium is divided and reflected toward the centre about 1 cm.; using a chisel 1 cm. in width the pattern outline is deepened to the diploe. The utmost care is necessary in removing the graft, especially if it is large; if it is cut too thin there is danger of breaking it, or if too thick, of penetrating the inner table. On two occasions in removing large grafts, I included a small portion of the entire thickness of the skull. In each instance a small chip from the external table was placed in the opening; subsequent X-rays of these

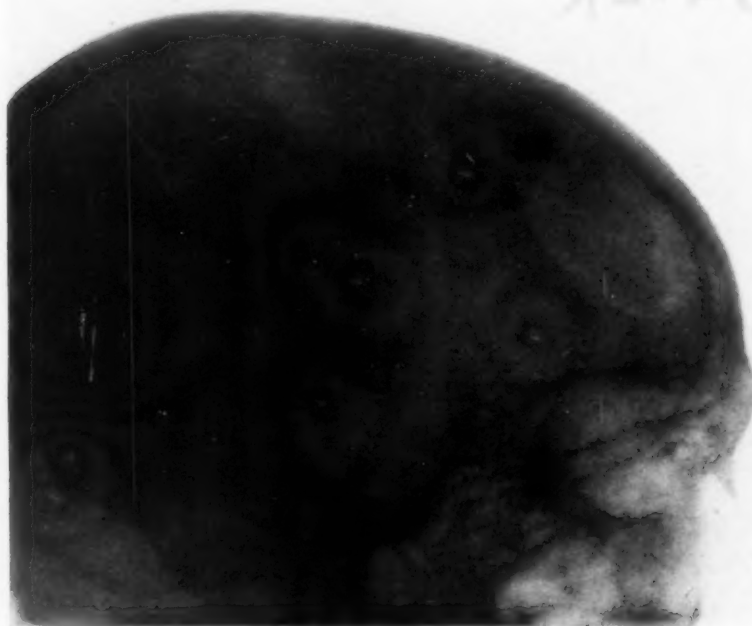


FIG. 21.—Case VIII, Private S. Transplant four months later, osteogenesis active.

cases showed that the defects were completely filled in. Some operators remove chips from the external table and transplant them with the attached pericranium. I prefer a single graft for the following reasons:

1. It can be sutured to the pericranium and there is little danger of displacement on account of hematoma or accidents to the dressings.
2. Resting on the diploe it prevents to some degree an increase of extradural pressure.
3. From the patient's point of view the single plate is to be preferred because it is solid, the defect has the normal contour of the skull and the fear of injury to the exposed brain is done away with immediately.

The graft is placed over the defect and held in place by interrupted sutures of fine chromic catgut, the deep layers of the flap are closed with interrupted sutures of fine chromic. If a more rapid closure is desired, a

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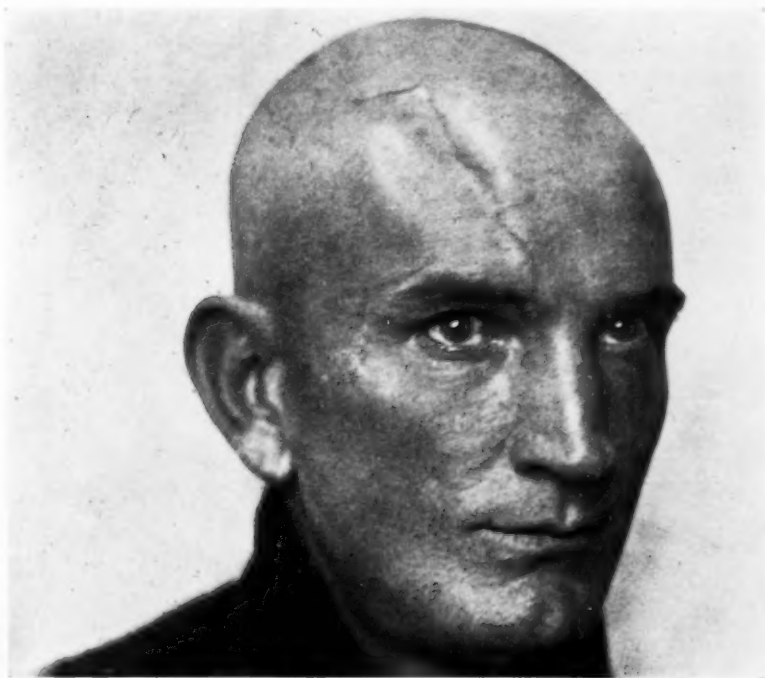


FIG. 22.—Case VIII, Private S. Defect before operation.

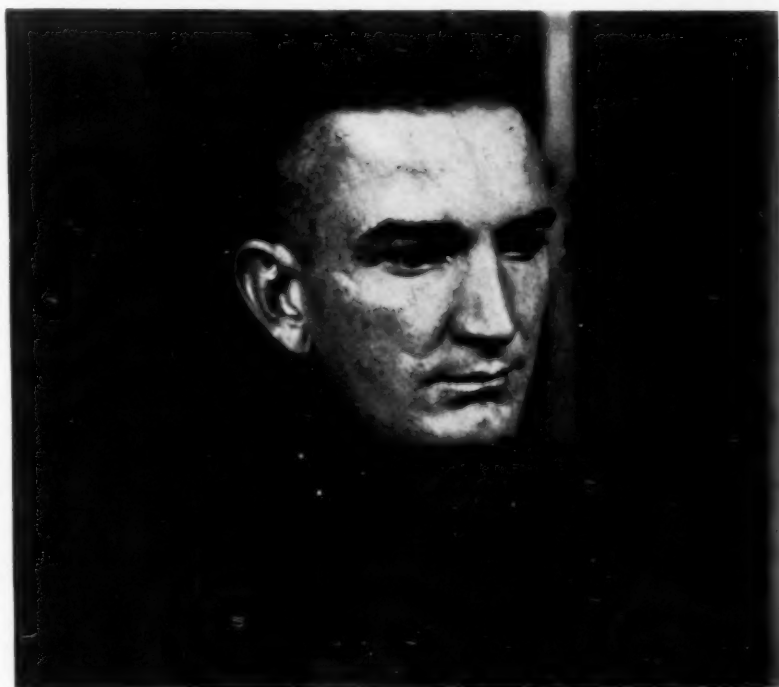


FIG. 23.—Case VIII, Private S. Defect after operation.

continuous deep layer of fine chromic may be used or interrupted silk-worm gut only.

In a fair proportion of these cases shock is marked, and while we have been prepared for transfusion of blood it has not been necessary, the usual treatment for shock sufficing. The patient's blood should be typed, however, and a suitable donor obtained prior to operation, in order to be prepared for any eventuality. The local treatment is the same as outlined under post-operative management. Post-operative hæmatoma has developed on two occasions. The serosanguinous fluid was removed in each case on the fourth

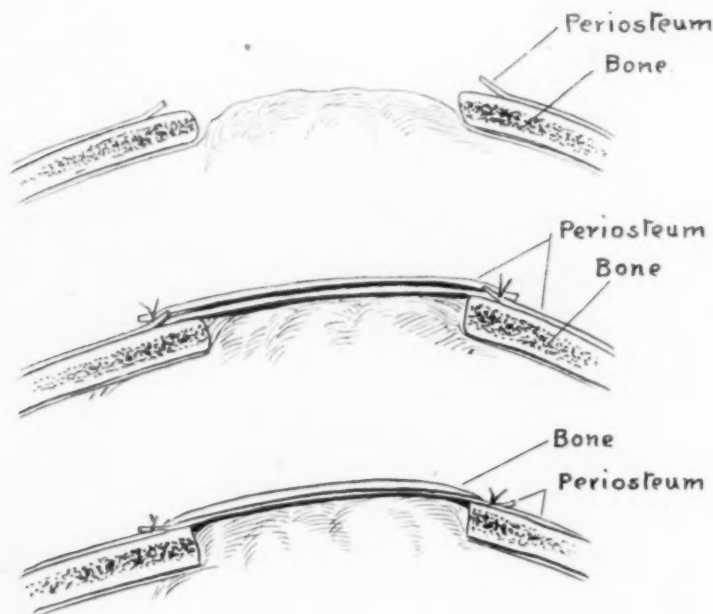


FIG. 24.—Sagittal section before and after cranioplasty.

day with a syringe and 19g needle; osteogenesis continued without interruption. The results in these cases have been satisfactory; in each instance symptoms complained of prior to operation have been entirely relieved.

This report is the result of a study of sixty-two patients with skull fracture, who were admitted to the Emergency Surgical Service of the Samaritan Hospital, Philadelphia, and at the U. S. General Hospital No. 6, Fort McPherson, Ga., during 1918 and 1919.

Of the sixty-two cases, forty-six had acute cerebral lesions associated with fracture of the cranium which were demonstrated either by X-ray, operation or post-mortem; of this number 24, or 52 per cent., were operated upon (cases of concussion and contusion not included).

MANAGEMENT OF INJURIES TO THE CRANIUM

Of the Operative Cases.—There were eight fractures of the vault with no deaths; sixteen fractures of the base and vault with eight deaths; six operations for defects, no deaths. Total mortality in the acute cases, $33\frac{1}{3}$ per cent., or of all operative cases 26.6 per cent.

Of the Twenty-two Non-operative Cases.—There were seven fractures of the vault, no deaths; fractures of the base, thirteen, two deaths; fractures of the base and vault two, two deaths; total mortality, 18 per cent.; combined mortality (operative and non-operative) in the acute cases, 26.1 per cent.

Of the acute lesions, special mention should be made of the case of massive

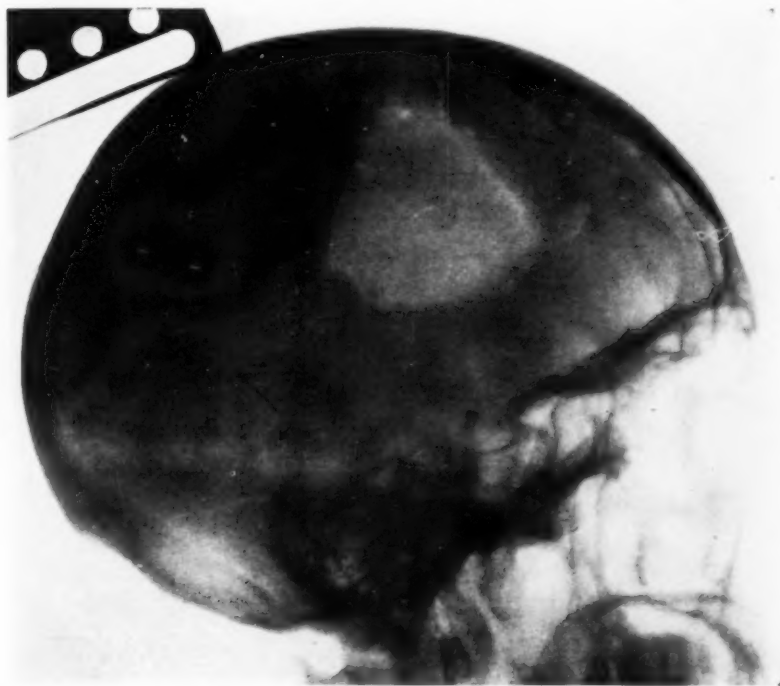


FIG. 25.—Case X, S. Defect fronto-parietal region left.

cerebral contusion, which on routine examination showed an increase of cerebrospinal pressure without an accompanying rise in blood-pressure (see Case Report X); Case V, Traumatic Thrombosis of Cavernous Sinus, and Case IX, Subdural Hemorrhage Associated with Cerebral Laceration.

The following cases are of sufficient interest to justify reporting:

CASE I: Illustrates the increase in blood-pressure in extradural lesions.—Private B, struck in left mid-temporal region with a piece of coal as large as two fists, thrown a distance of fifty yards. He sustained a laceration and contusion of the scalp with compound depressed fracture of temporal bone and extradural hemorrhage. He walked into operating pavilion with no evidence of increased intracranial pressure except an increase in blood-pressure (systolic 155, diastolic 85).

JOHN O. BOWER

Treatment.—Debridement, complete closure. Small drain inserted to control hemorrhage. This was removed in twelve hours. Primary union, no complications.

CASE II: Illustrates the increase in blood and cerebrospinal pressure in moderate extradural pressure and slight cerebral contusion.—F. W., male, twenty-eight, patient thrown from motorcycle when he collided with machine, sustained compound depressed fracture right frontal region.

Examination.—Patient unconscious; no paralysis; reflexes increased; right pupil contracted; no reaction to light; left pupil dilated; reacted to light slightly; blood-pressure 150-85; pulse 84; temperature 98; cerebrospinal fluid blood-stained, pressure 7 mm. of Hg in lateral prone position; lacerations extensive over right frontal area with irregular fracture; depression involving mostly the inner table.

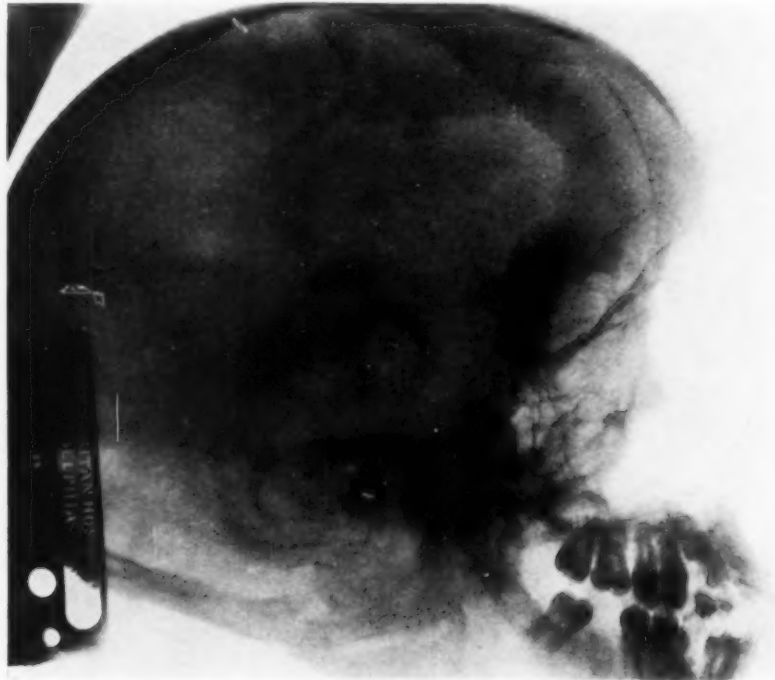


FIG. 26.—Case X, S. Röntgenogram two weeks after operation.

Operation.—Debridement, removal of bone over an area of 3 cm. in diameter; fragments re-aligned; complete closure; no complications.

CASE III: Illustrates the value of prolonged rest in massive cerebral contusion.—McC., male, struck and thrown several feet by auto, sustained a compound depressed fracture of the right frontotemporal region, with marked evidence of increased intracranial pressure. Subtemporal decompression was done.

This patient demonstrates the value of prolonged rest. When he left the hospital he thought it was a shoe factory and he was employed there. After three months of absolute rest, he recovered completely, except for slight vertigo when he changed from a recumbent to a sitting position. Patient refused operation for defect.

CASE IV: Illustrates the value of delayed debridement in profound shock.—M. S., female, age forty-six; struck and thrown twenty feet by a trolley car; she sustained lacerations and contusions of scalp; fracture of base of skull and

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dislocated sacrum. She was brought to the hospital unconscious in profound shock; pulse 120; temperature 97; heart sounds very weak; B.P.S. 90; D. 60; examination showed extensive lacerations of scalp of frontotemporal regions; bleeding from ears and nose; pupils widely dilated, no reaction to light; reflexes normal; C. S. F. pressure not taken. Patient's condition considered too serious for operation. At the end of twelve hours, however, she had reacted from shock and a debridement was done; convalescence normal, wound healed primarily.

CASE V: *Unusual case of traumatic thrombosis of the cavernous sinus.*—E. B., age, twelve, male; patient struck in left orbital region by an indoor baseball. No symptoms for twenty-four hours, when he complained of left frontal cephalalgia. This gradually increased in severity. At the end of seventy-two hours he suddenly developed a convulsive seizure, general in type, lasting five



FIG. 27.—Case X, S. Defect before operation.

hours. He was unconscious forty-eight hours; no temperature, pulse 100; ocular examination showed a slight exophthalmus and subconjunctival ecchymosis of moderate degree, left eye. After seventy-two hours exophthalmus was marked. He regained consciousness on the fifth day. On the eighth day he again developed convulsions, epileptiform in character. He was sent to the hospital, temperature 98.2, pulse 120, respiration 28. Examination three hours after onset of convulsions showed patient in unconscious state, with no evidence of paralysis. Right upper and lower extremities were alternately flexed and extended, reflexes superficial and deep, increased, Babinski's questionable, cerebrospinal fluid slightly blood-stained.

Oculist's Examination.—Marked proptosis of left eyeball with tendency to deviate outward; marked swelling of the lids and chemosis of conjunctiva. Left pupil smaller than right, reactions questionable. Right eye pupil round, media clear, disc 7 x 8, axis 90, veins overfilled; left fundus pathologic but details not obtainable in the room. Twenty-four hours later examination showed marked swelling of the disc. Blood-pressure systolic 188, diastolic 95. An hour after operation, 122-85.

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Operation.—Left subtemporal decompression; extradural hemorrhage small in amount; dura tense, twice normal thickness, pulsation slight; cortex markedly cedematous. Patient regained consciousness within twelve hours; three days after operation a serosanguinous fluid was removed from peri-orbital tissues; reoperation for defect four months after initial operation. Patient's condition was normal except for moderate exophthalmus, one year after operation. X-ray shows that the transplant in several places had obtained the normal thickness of the skull. The oculist's report was negative.

CASE VI: *Illustrates the importance of blood and cerebrospinal pressure observations prior to and following cranioplasty.*—Lt. B. H., put his head out of



FIG. 28.—Case X, S. Defect after operation.

a car window while passing through a tunnel, was struck, sustaining a compound depressed fracture of the frontal region. He was operated upon immediately; wound had healed at the end of six weeks, leaving a defect 3 x 2 cm. close to the left frontal sinus. He complained of fear of injury to the part, and, at times, vertigo. His systolic pressure was 118, diastolic 90; cerebrospinal pressure, second lumbar interspace in the upright position was 18 mm. of Hg. He was operated on for defect three months after the wound had healed; 48 hours after operation he developed intense cephalalgia, most marked over the left frontal sinus. His pulse dropped from 72 to 50 and his blood-pressure rose to 144 systolic; diastolic remained unchanged. Ordinarily, the possibility of meningitis would be thought of, but, since there was no temperature and no marked change in the cerebrospinal pressure, the symptoms were attributed to traumatic frontal sinusitis and had entirely cleared up on the fourth day. He was discharged from the service one month after operation. Subsequent X-rays showed that osteogenesis had continued without interruption.

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CASE VII: *Illustrating initial absorption of edges of the transplant with subsequent active osteogenesis.*—Sergeant M. E. H., received high explosive gunshot wound of the skull, shell fragments perforating helmet. A debridement and decompression were done immediately. The wound healed within three weeks; ten months later he was operated upon for defect. External table with attached pericranium was used to fill in defect. The röntgenographs show initial absorption of the transplant with subsequent active osteogenesis.

CASE VIII: *Showing that the pericranium can be apposed to the dura without interfering with osteogenesis.*—Private J. S., while driving motorcycle near Coblenz collided with an automobile and sustained fracture compound comminuted

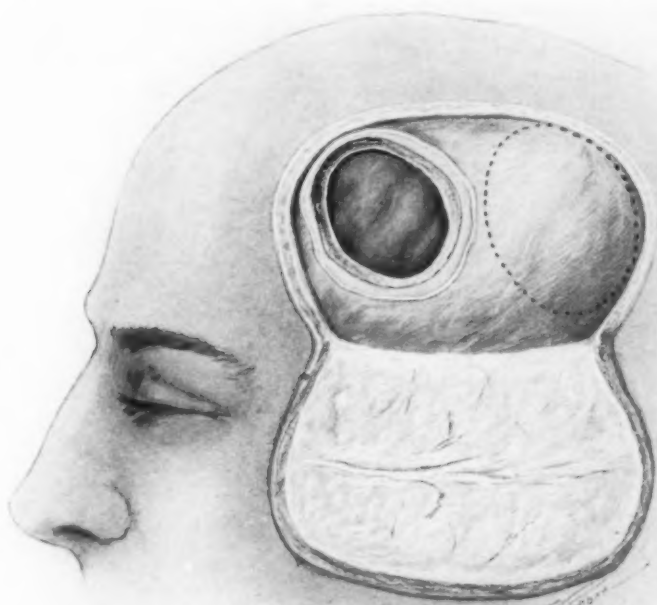


FIG. 29.—Case X. S. Large flap including scar. Pericranium reflected toward the centre of the defect; dura separated from inner table for a distance of one centimetre; edge of defect roughened with rongeur.

of the right frontal region with a linear fracture radiating from depression in to right orbit. A debridement and decompression were immediately done and the wound healed in two weeks. On examination ten months later he complained of vertigo, tingling sensation on extensor and flexor surfaces of both forearms, dimness of vision and cephalalgia, all of which had persisted since his first operation. He was very restless and depressed. In this instance the graft had a tendency to curl and when placed in the defect the normal contour of the skull was maintained, the pericranial side of the graft being apposed to the dura. Patient was immediately relieved of all symptoms and subsequent X-ray showed that osteogenesis continued without interruption.

CASE IX: *Illustrates marked increase of cerebrospinal pressure due to subdural hemorrhage with only moderate increase in blood-pressure.*—G. W. K., male, age sixty-nine, was admitted to the Samaritan Hospital with a history of having fallen down a flight of stairs three hours before. He was unconscious, respira-

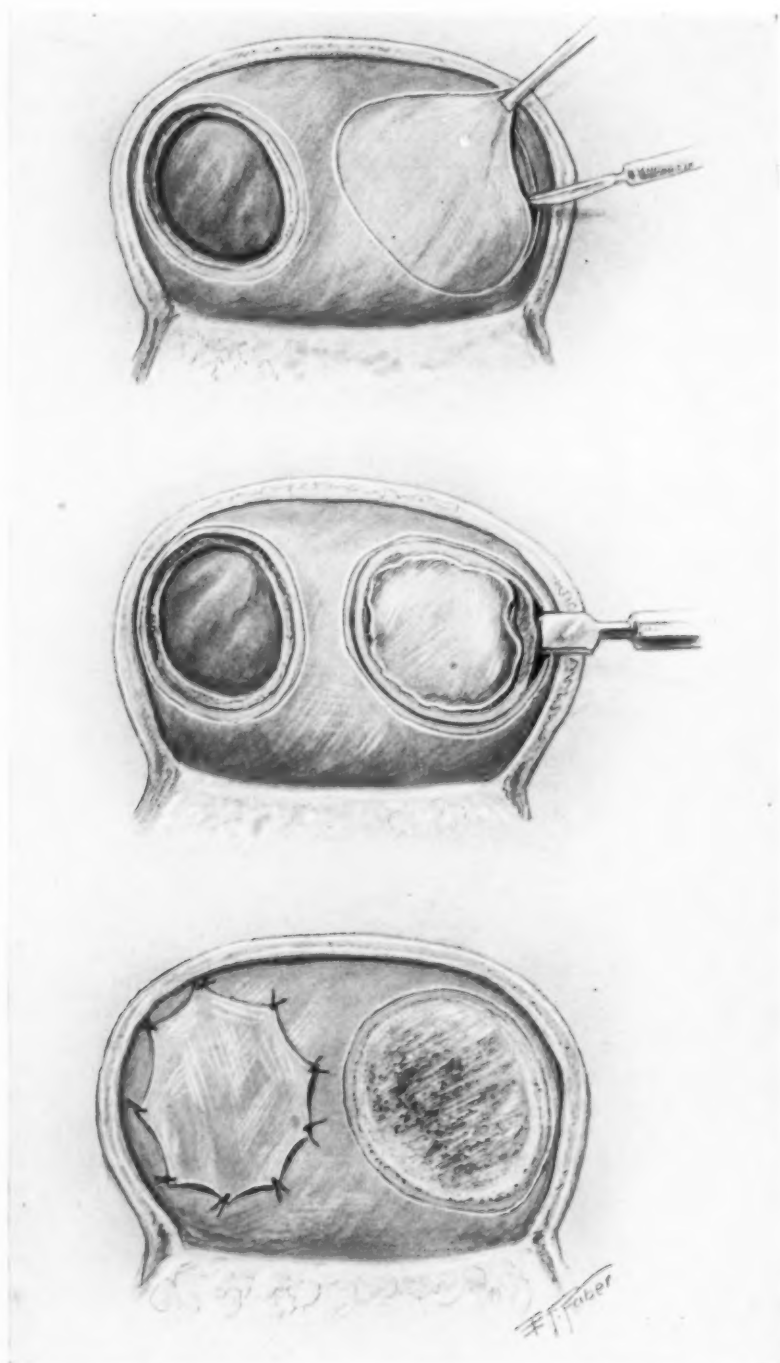


FIG. 30.—Case X, S. Separation and reflection of pericranium for a distance of one centimetre. Removal of external table with attached pericranium. Transplant in place.

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tions Cheyne-Stokes in character, pupils dilated and fixed, pulse 52, blood-pressure, systolic 140, diastolic 65; no involvement of cranial nerves. There was a partial paralysis of the muscles of the left lower extremity; reflexes were negative except slight exaggeration of patellar right and diminished left. A hematoma beneath the occipitalis was present; there was no bleeding from the auditory meatus; the cerebrospinal pressure in the lateral prone position in the first lumbar interspace, was 36 mm. of mercury; the fluid was deeply blood-stained, and on the withdrawal of 3 c.c. the respirations which had practically ceased were immediately resumed. A right subtemporal decompression was immediately decided upon; before the bone could be removed the patient stopped breathing, artificial respiration was resorted to and the first voluntary respiratory effort occurred twenty minutes later, during which time an area of bone 8 cm. in diameter had been removed and about 250 c.c. of blood clot and free blood were removed. Examination of the cranium showed that the inner table of the right frontal was depressed, a portion projecting into the right middle and inferior frontal convolutions for a distance of 1.5 cm.; about two drachms of pulpified cerebral substance came away with the washings. (Using normal saline with the aid of a No. 14 F. catheter the cranium was washed free of debris.) Bleeding was controlled by placing a gauze strip against a rent in the superior petrosal sinus and the wound was closed. The patient left the operating room in good condition; respirations were 22, pulse 88. He reacted well for the first ten hours, then his temperature began to rise, reaching 105.3 sixteen hours after operation, when he succumbed. The respirations were of the Cheyne-Stokes type for four hours prior to death.

CASE X: Illustrates the importance of a definite routine in the management of cranial injuries, especially repeated observations of cerebrospinal pressure.—S., male, age twenty-nine, brought to the Samaritan Hospital with a history of having been thrown from motorcycle, striking left frontotemporal region.

Examination.—Patient unconscious, respiration 20, shallow; pulse 82, volume fair; pupils dilated; reaction slight; paralysis of left upper and lower extremities; deep reflexes absent on left, increased on right side; blood-pressure systolic 100, diastolic 55 mm. of mercury; lumbar puncture showed cerebrospinal fluid to be blood-stained; pressure in the lateral prone position, second lumbar interspace, 22 mm. of mercury. Wound in temporoparietal region ragged, 4 cm. in length with probable depression of temporal bone. Patient placed in Fowler position, head shaved; painted with tincture of iodine and antiseptic dressing applied. Three hours later ophthalmoscopic examination showed right eye, media clear, disc almost obliterated, veins overfilled, arteries small, entire retina, especially portion surrounding disc, oedematous; left eye apparently normal; blood-pressure systolic 112, diastolic 68; cerebrospinal pressure 28 mm. of mercury in the lateral prone position.

Operation.—(Seven hours after admission) Debridement, left subtemporal decompression; depressed fracture frontal bone moderate; no pulsation of dura; ascending frontal and ascending parietal convolutions hemorrhagic and oedematous. Patient regained consciousness six hour later, wound healed normally; blood-pressure after decompression, systolic 92, diastolic 58; prior to discharge from hospital four weeks later, systolic 118, diastolic 70, cerebrospinal pressure in the lateral prone position 5 mm. of mercury. Operation for defect four months later.

SUMMARY

1. In injuries to the cranium or its contents, lumbar puncture with spinal fluid pressure observations are essential to proper management.
2. In certain cases, withdrawal of fluid may so reduce intracranial pressure that operation may be avoided; in borderline cases it is a means of determining

early the least degree of intracranial tension; blood-pressure reading at definite intervals may accomplish this in part, but one may have an increase in intracranial pressure and no corresponding increase in blood-pressure.

3. Cerebrospinal pressure observations are important before and after plastic operations on the skull.

4. Finally, repeated examinations of the spinal fluid for microscopic blood are of importance in differentiating the less severe types of cerebral trauma.

I am indebted to Dr. W. W. Babcock, Chief of the Surgical Service at the Samaritan Hospital, for the privilege of operating on a number of the cases reported, and to my colleagues, Drs. John Leedom and G. Mason Astley, for the privilege of studying the operative and non-operative cases on their respective services.

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CANCER OF THE TONGUE

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FOUR cases of cancer of the tongue were admitted to our hospital at short intervals during the summer of 1919. This group of cases, though small, provides a picture of the disease which demonstrates how speedily cancer in this region may become a menace to life.

From the duration of the disease and the results, the four cases may be considered in the following order:

CASE I (4652).—Female, age seventy, had noticed an ulcerating area on her tongue three years before presenting herself for treatment. On account of the advanced stage of the disease no operation was done. She lived eight months. This case is recorded as evidence of the slow progress of cancer in the aged. At seventy years this patient lived more than twice as long as the average of unoperated cases.

CASE II (4753).—Male, age forty-nine, had noticed the growth nine months before coming to the hospital. Origin apparently unprovoked. He lived ten months after operation.

CASE III (4631).—Male, age forty-seven, first observed a hard ulcerated area on the margin of the tongue seven months before operation. Origin ascribed to rough edge of tooth. He lived sixteen months after operation.

CASE IV (4739).—Male, age fifty-one, was operated upon four months after growth appeared. Growth began following a sore caused by the cutting edge of a molar tooth. Referred for operation by his dentist. He is still living without recurrence three and one-half years after operation.

The lesson to be learned from a study of this comparatively small group of cases is that cancer of the tongue, except in the aged, grows rapidly, invades the lymphatics early, and becomes hopelessly advanced in from six to nine months. The fatal pinch is seen too often as the result of ignoring a small sore for weeks or months. While this is true of cancer invading any organ it is particularly so when the malignant process develops in a moist actively functioning tissue such as the buccal mucosa.

In a review of the literature we find that cancer of the tongue, usually in the form of epithelioma, is found to be on the increase. As compared in frequency with cancer invading other regions of the body, as the stomach, breast, rectum, uterus, etc., it stands about fifth. Mr. Barker (Barker's System of Surgery, vol. ii, p. 578), of London, has reported a series of tables showing that during a period of thirty years, cancer of the tongue increased from 2.6 per cent. to 11.5 per cent.

Initial Stage.—Although the medical profession and laity have not been aroused to the importance of excision of cancer of the tongue when it first appears in the form of a wart, fissure or superficial tubercle, cases are operated upon now in early mid-period of development more frequently than in former years. Butlin (British Medical Journal, January 2, 1909) describes five con-

ditions which appear on the tongue that are ear-marks of cancer: "(1) A little plaque-like hard sore, smooth and polished, neither ulcerated nor eroded. (2) The transformation or replacement of a simple ulcer by feeling a little stiffer and a very little firmer. (3) The transformation of an entire plaque of leukoplakia into a plaque of cancer. The difference is marked by a very slight thickening, a denser white, and furrowing in various directions, but without excoriation or ulceration. (4) The transformation of one small area of a leukoplakia tongue into cancer, only marked at first by a very slight and superficial hardening. (5) A white, warty growth or compound wart, neither broken nor ulcerated and feeling at first as if it were fixed to the mucous membrane and quite superficial."

Perhaps in many instances such manifestations would fail to reveal cancer tissue, and would come under a classification of "pre-cancerous" lesions. One is animated nevertheless, to contrast the end result of excision of a new growth in the above stage with the altogether too frequent necessity of a sweeping operation required to remove cancer-invaded lymphatic nodes in the region between the floor of the mouth and the clavicle. A campaign of education and enlightenment of the public and the medical profession, such as the American Society for the Control of Cancer has been conducting, is opening the door of hope in this direction.

Mid-period of the Disease.—A mid-period in the life of cancer of the tongue has been described by Blair (Blair, *Surgery of the Mouth and Jaws*, p. 556). He considers it starts when the objective symptoms render the diagnosis rather obvious.

This is a most important period, because during it the growth passes from the operable to the inoperable and hopeless stage. It may be assumed that during the initial stage the patient has been trying home remedies without success. Then the chronicity of the sore prompts him to consult a physician. Here opportunity is given for diagnosis with the aid of the microscope and attacking the disease in the early mid-period. If the diagnosis is not promptly established further loss of time adds greatly to the risk of incurability. It is well to remember that squamous epithelioma once started does not recede. If the patient is luetic the lesion of the tongue may clear up somewhat under specific treatment but cell division of the cancer continues. Accuracy in diagnosis then is essential and time is of such pressing importance that therapeutic tests should yield to the more expeditious and precise methods of microscopical examination of tissue.

We note the expressions of Warren and Butlin upon the vital importance of early diagnosis. "Owing to the appalling danger," wrote Warren, "there are few diseases in which early diagnosis is more essential than in cancer of the mouth. To give the patient 'a chance' is, under such circumstances, to give the cancer a chance to form an irresistible hold, and to take away all hope of complete recovery from the patient."

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Symptoms.—The cardinal symptoms of this mid-period as it progresses are ulceration, pain, hemorrhage, salivation, lymphatic infection, anemia, and loss of weight. The ulcerated area may have a smooth red surface, but usually it is ragged, foul, and covered with necrotic tissue which bleeds easily. Again Blair (Blair, *Surgery of the Mouth and Jaws*, p. 558) calls attention to the appearance of the edges of the growth which are rolled and prominent, seldom punched and almost never undermined.

Pain is an early symptom. It is not local but referred to the region of the ear and side of the head. Case No. 4639 complained of intense hemicrania. The pain was almost continuous, causing insomnia and interference with deglutition.

Hemorrhage occurs whenever the surface is excoriated or impinged upon by carious teeth or particles of unmasterated food. Except in the later stages, bleeding is rarely of an alarming nature.

Salivation, in some degrees, is constant and troublesome from the beginning.

Cancer of the tongue, even in the initial stages, must be a local process for a period of some length. Lymphatic infection, however, has begun in too many cases before the diagnosis is established. The assumption that glandular infection does not exist because nodes are not felt is proven erroneous repeatedly when the superficial layers of the neck are laid open. In the most rapidly progressive cases the glands may be infected within a few weeks after the disease within the mouth has become actually carcinomatous. On the other hand, in rare cases there is good reason to believe that carcinoma of the tongue may exist six months or longer before the glands are involved. However, Jacobson (Jacobson and Stewart, *Operation of Surgery*, p. 445), of Guy's Hospital, reminds his readers that epithelioma of the tongue, usually thought a slow cancer, here in a moist, warm cavity, much irritated and never dry, is terribly rapid; that gland invasion is not only certain but inevitably early as well.

One may expect to find the first invaded gland in the region of the neck corresponding to the direction of the lymph channels draining the area of the tongue which is invaded. If the lesion involves the tip of the tongue, careful palpation should be made for enlargement of the glands in the submental and sublingual groups. Cancer of the border of the tongue drains into the submaxillary gland and the surrounding lymphatic glands. One vessel runs from the neighborhood of the frenum to the deep cervical glands lying near the bifurcation of the common carotid. When the lesion involves the base of the tongue, metastasis takes place in the superior deep cervical lymphatics. These drain all parts of the mouth, fauces and upper part of the pharynx.

In moderately advanced cases of carcinoma in any region of the tongue or floor of the mouth, any or all cervical lymphatic gland groups may be found to be involved.

Anemia and loss of weight are not conspicuous symptoms in the early stage

of cancer of the tongue. The patient may remain well nourished and show only slight evidences of change in blood picture until the lesion of the tongue has become sufficiently advanced to interfere with the appetite and deglutition, or until invasion of the lymphatic system has become well established.

Prognosis.—The outlook in any case depends primarily upon the age of the patient, the stage of the disease, and the method adopted for its treatment. Among patients under forty years of age, cancer of the tongue does not present a hopeful picture unless detected in its initial stage and eradicated by intrabuccal and cervical operations combined. The average duration of life of any unoperated patient is less than two years. If not treated surgically, cancer in this region invariably progresses to a fatal termination, death coming from poisoning, starvation, and exhaustion.

Of 172 cases of cancer of the tongue and mouth at the Massachusetts General Hospital, reported by Warren (J. C. Warren, Report of Cancer of the Mouth and Tongue, before Second Congress of the International Surgical Society, September, 1908), 29 per cent. were found to be inoperable. And it is doubtful if this percentage of inoperable cases has been reduced materially up to the present day.

At that time Warren placed the percentage of cures after operation at 17.5 per cent.

Butlin (Butlin, British Medical Journal, January 2, 1909) reported an operative mortality of 10 per cent. and 33.9 per cent. cures.

In general it may be said that treated surgically in the initial stage or in the early mid-period of the disease, the present day mortality from operation is not above 5 per cent., proportion of three-year cures at least 30 per cent. Passing through the mid-period we frequently find the floor of the mouth invaded and the operative mortality increased rapidly while the percentage of cures falls off abruptly. Life is seldom prolonged by secondary operations.

Treatment.—The treatment of cancer of the tongue is surgical whenever the disease is found to be in the operable stage. The value of X-rays and radium as therapeutic measures is still open to discussion. The former is used as an adjunct to surgery after the cancer-bearing tissues have been removed by careful dissection. Radium in our experience is too often found disappointing to be employed in other than the inoperable and recurring forms of the disease. The tendency for patients to seek surgical treatment last instead of first is responsible for many sad pictures of incurability.

The best known methods of operation have been described by Judd, Greenough, Whitehead, Kocher, Butlin, Crile, Von Bergmann, Poirier, Bloodgood, and Blair. The contributions of Butlin and Warren marked an epoch in the surgical treatment in that they established the principles upon which the present technic is carried out. This was based upon an intimate knowledge of the cervical lymphatic centres draining the tongue and the floor of the mouth. From their writings it was made clear that a knowledge of the

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distribution of the cervical lymphatic centres draining the tongue was of paramount importance to the surgeon in his attack upon cancer in this region. Warren showed that anatomically the base of the tongue was separate from the body of that organ; that the lymphatic system of these two areas was quite distinct. He also indicated that the lymphatic system of the two divisions of the tongue was separate. Thus, it is feasible to leave the base of the tongue when the site of the cancer involves the body and to remove one-half of the tongue when only one margin has been invaded by new growth.

Kocher's operation in all cases moderately advanced, consists in dividing the jaw in the mid-line and thus widening the field of operation within the mouth in order to attack the disease at the base of the tongue and on the walls of the pharynx. Recurrences after operation are seen frequently in the floor of the mouth so that a common failure in the operative technic is to leave cancer tissue at this level. The Kocher operation, although associated with an increased operative mortality, gives a wide exposure of the base of the tongue, floor of the mouth and pharynx, thus affording the best opportunity for complete eradication of the disease. Considerable discussion has centred around the advisability of doing the neck dissection and intraoral operation in one stage or two. Rules are not applicable. It is more desirable to do both during the same operation, and this is the usual method now in practice. However, patients vary much as operative risks, and surgeons vary considerably in skill and practice, so the decision to make the operation a one stage or two stage procedure must remain always a test of surgical judgment. The necessity of carrying out a complete dissection of the lymphatic vessels and the lymphatic glands in any case is no longer disputed. Whenever this major part of the operation is omitted the surgeon leaves his patient with a well recognized danger of recurrence.

The Cautery for the Purpose of Dissection.—We are aware that many surgeons are loath to use the cautery knife in the dissection of a cancer-invaded field. While the method is still open to inquiry we have employed it on account of its obvious advantages. In our operations thus far we have carried out the neck dissection from the floor of the mouth down to the level of the cricoid cartilage, removing one or both submaxillary glands and all lymphatic vessels and nodes of both sides of the neck. With knife dissection this is a time-consuming operation. About half the period is occupied in clamping and ligating small blood-vessels. The loss of blood is usually slight, but on occasion it may be considerable. It is common knowledge that cancer patients are affected more unfavorably by hemorrhage than other individuals. It is also a known fact that cancer is a blood-destroying disease, anemia being one of the familiar symptoms. Therefore, while it is important to conserve the blood volume during operations in general, there is a particular reason for doing so when the operation is for cancer. In consequence of this recognized necessity for saving time and blood volume in carrying out the complete operation for cancer of the tongue we continue to employ the cautery knife as an

instrument for dissecting out the lymphatics of the neck. The method has shortened the time of operation approximately one-half.

Operation.—If oral hygiene has been neglected, as it usually is in these cases, a few days will be required for preparatory treatment by the frequent

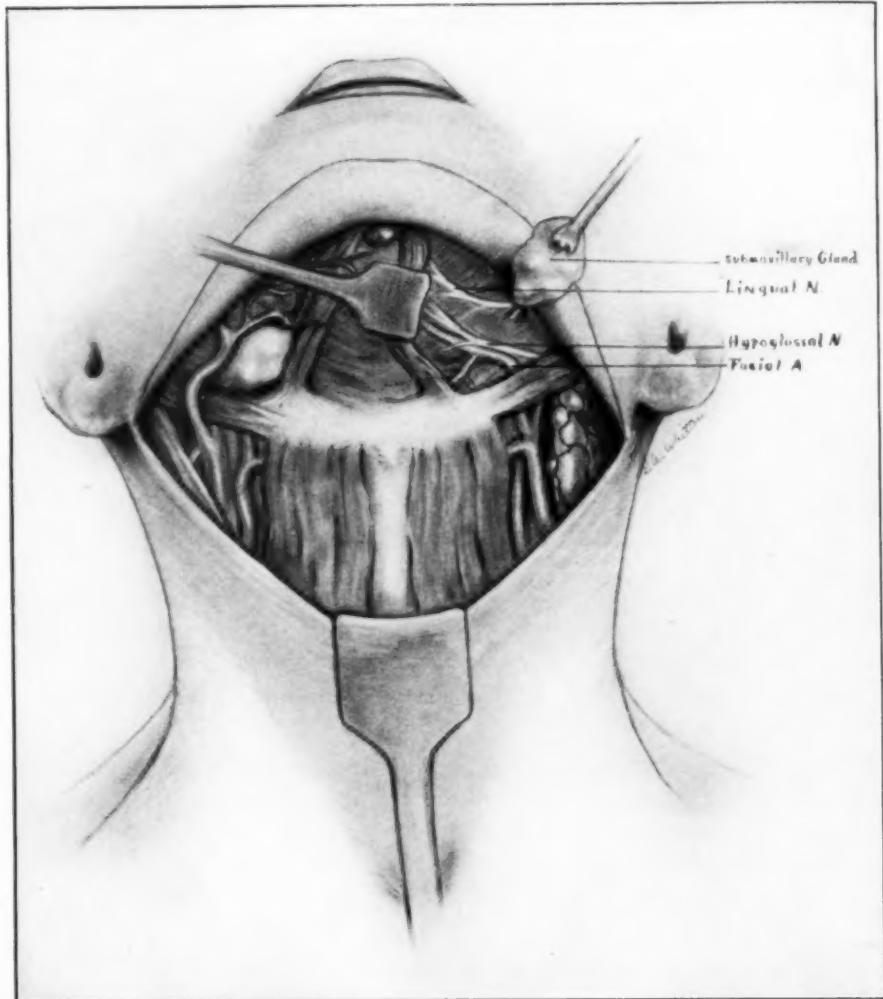


FIG. 1.—Shows the lingual nerve passing adjacent to the deep part of the submaxillary gland, and the hypoglossal nerve and facial artery in relation to the deeper structures of the neck.

use of mild alkaline and styptic mouth washes. With the patient in a semi-upright position, ether is administered by the intrapharyngeal method. The field of operation is prepared with iodine, half strength solution being used in the mouth. The neck dissection is done first. A transverse incision, slightly curved downward, is made from a point about 2 cm. below the lobe of the left ear to a corresponding point below the right ear. The knife is used in making the incision through the skin and dissecting back the flap. Then with the

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cautery knife, the lymphatic gland-bearing area is dissected *en masse* from the entire cervical region thus exposed. In removing the submaxillary gland on the healthy side care must be taken to preserve the hypoglossal nerve and the lingual nerve (Fig. 1), between which passes the duct of the gland. A small branch of the facial nerve supplying the angulæ oris, which depresses

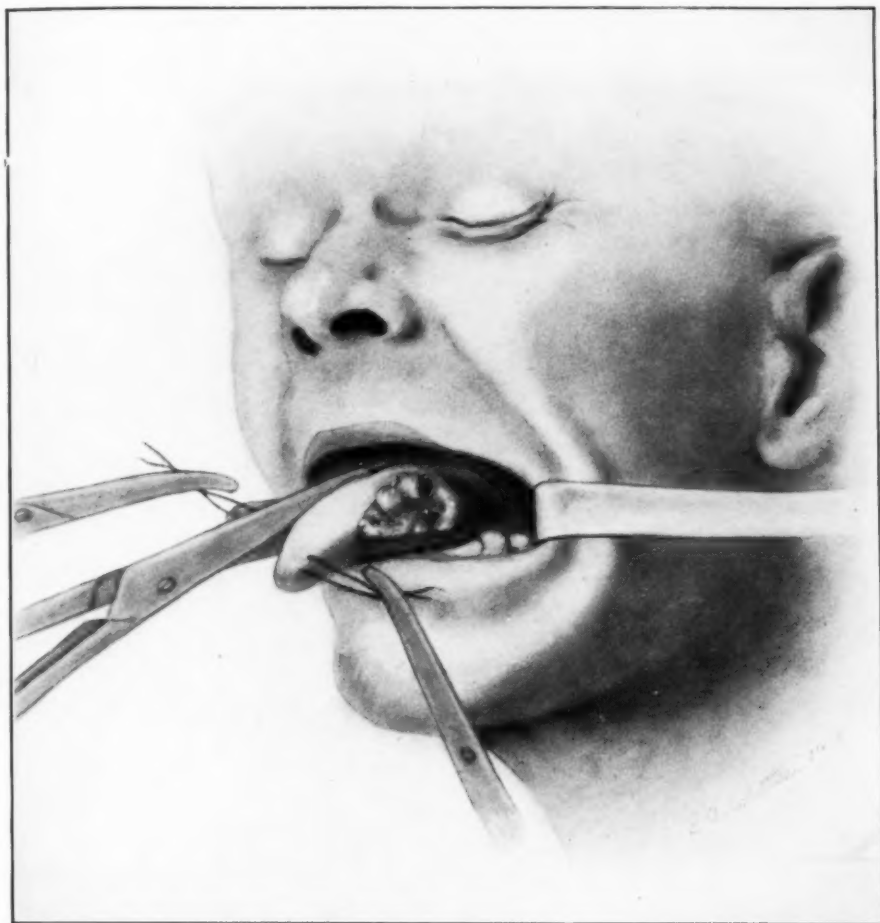


FIG. 2.—Case IV. Extent of cancerous growth invading the margin of the tongue.

the angle of the mouth, is frequently injured in dissection close to the ramus of the jaw. This nerve is superficial and very small, but important because, if severed, it causes drooping at the angle of the lower lip. Perforation of the floor of the mouth is occasionally unavoidable when the operation is done in one stage. This invariably complicates recovery by a disagreeable infection.

On completing the dissection the skin margins are brought together and a rubber tissue drainage is placed in either side of the neck.

The second part of the operation follows and consists in removing a part

or whole of the tongue. In the three cases herewith reported this step was carried out in the following manner:

The tongue was drawn forward on a retention suture passed through the tip. The mucous membrane on the floor of the mouth was then incised and dissected free, the line of separation being fully 1 cm. distant from the growth. The lingual artery, standing out somewhat like a cord, was next exposed by blunt dissection and tied. The body of the tongue was then divided along the raphé, care being exercised to have the line of division extending wide of the growth (Fig. 2). The diseased half was drawn upward and removed by cutting the geniohyoglossus muscle and meeting the mid-line incision by a curved section at the root of the tongue. In Cases III and IV, the disease was limited to the margin of the tongue. In Case II, however, the edge of the carcinoma involved the floor of the mouth and in removing the structures here a communication was made with the neck. This was difficult to close, and complete union did not result. The secretions of the mouth drained into the neck with infection as an inevitable consequence. A sizable rubber tissue drain had been placed in the neck wound and a bad infection thus averted.

In our cases, speech faculty with lingual phonetics returned, so that oral communication was established in from seven to ten days after operation. For several weeks after operation the remaining half of the tongue did not come in contact readily with the soft palate, hence the linguals, d, k, t and q were pronounced with difficulty. In one case the motor function of the tongue was so interfered with that for nearly two months the patient was unable to place morsels of food between the teeth. He frequently aided mastication by using his fingers for this purpose, as on the first occasion when he reported that he had "lost a piece of candy" in his mouth. At the end of six months all of these patients had good function of the tongue, with only a slight lisp and no embarrassment during mastication.

NOTE ON THE PATHOLOGY AND SURGICAL TREATMENT OF LEUKOKERATOSIS LINGUÆ

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LEUKOKERATOSIS of the tongue and buccal cavity is not exclusively the consequence of syphilitic infection, because both diabetes mellitus and the arthritic diathesis frequently offer a favorable soil for the development of this morbid process, being in fact general predisposing causes. But the determining factor must be some type of local chronic irritation of the mucosa, particularly tobacco. Women are rarely afflicted. Out of a total of 848 cases collected from the literature, including 10 of my own, there were only 30 females.

The normal histology of the mucosæ comprises a stratum germinativum, or layer of basal cells, and secondly, a stratum filamentosum, or layer of polyhedric cells united by cellular filaments. The mucosæ do not normally contain eleidin and instead of a stratum granulosum there is a uniform layer of flattened and very imperfectly keratinized cells, containing a flat nucleus. On account of the absence of a horny layer and eleidin the mucosæ are transparent, while their rosy tint is due to the richly vascularized subjacent dermal papillæ.

In leukokeratosis of the mucous membranes eleidin is present and a horny layer exists, hence the white, pearly and opaque aspect of the patches. Consequently leukokeratosis is simply an epidermization of the mucosa but with an exaggeration of the characters of the epidermis. Otherwise put, it is a hyperkeratosis.

Histologically, leukokeratosis consists of two fundamental lesions, *viz.*, *hyperkeratinization of the mucosa* and *sclerosis of the derma*.

Lesions of the Mucosa.—The superficial horny layer of epithelium is very thick. One may distinguish an upper stratum composed of nucleated cells, staining with picric acid, and a lower stratum taking on a pink tint due to the large amount of diffused eleidin present. Eleidin is seen as minute particles disseminated in the cell protoplasm and above all in the shape of an intercellular network. Eleidin abundantly distributed throughout a tissue from which normally it is absent results in the formation of a normal epidermis or even hyperkeratinization of the mucosa.

A stratum granulosum develops—which normally is absent in the mucosæ—and may even reach a state of development much greater than in the normal epidermis. It contains cells whose protoplasm is laden with eleidin and surrounded by it. The cells are arranged in three or four superimposed layers, while at the level of the interstices of the papillæ there may be six or seven layers. Stained with picro-carmin these layers are seen as a bright red undulating band, the undulations representing its thick-

ness, and it would seem as if the mucous epithelium had undergone a kind of cutization.

Perrin has pointed out that this classic aspect is not always found; the diseased epithelium may simulate normal epidermis or present an irregular structure. The eleidin layer may be wanting at certain spots, the horny strata at others. Such atypical aspects may be due to the irregular evolution or long duration of the process.

Some observers maintain that Malpighi's layer is atrophied. The cells are flattened, stain badly, becoming progressively more shrunken and fatty as the free surface is approached. On the contrary, the interpapillary prolongations in the deeper parts are hypertrophied. These changes are the result of irritation of the cells by inflammatory lesions arising in the derma of the mucosa, which allows toxins to filtrate through the epidermis. The cloudiness of the cells indicates functional hyperactivity and explains the white aspect of the leukokeratotic patch which, according to Milian, is not due to the presence of a horny layer or to the stratum granulosum.

Lesions of the Derma.—The derma or mucous chorion is more or less extensively sclerosed, and is two or three times thicker than normally. In recent lesions there is an infiltration of young cells in the superficial layers and apex of the papillæ, especially around the vessels, which appear to be the starting-point of the pathological changes.

The vessels are at first dilated, then compressed and atrophied by the sclerotic tissue which invades their adventitia, hence loss of nutrition resulting in dekeratinization as a consequence. This dekeratinization is the cause of the small ulcers met with on the surface of the patches and may be regarded as true trophic disturbances. The muscle fibres are likewise involved in the sclerous process, becoming dissociated and atrophied.

The sclerous process extends quite a little beyond the surface of the patch and clinically it will frequently be noted that the patch rests upon a smooth, sclerous surface, indurated to the feel and devoid of papillæ extending outside the limits of the leukokeratotic lesion.

An accumulation of embryonal elements around the submucous glands may be found as well as an endothelial proliferation of the glands themselves, their functional disturbances being thus accounted for. In mild or recent cases, when the process is slow and torpid, the papillæ of the derma keep their shape and may undergo hypertrophy. If, on the contrary, the patch assumes a rapid evolution with sharp reactions, the papillæ disappear in the surrounding cell proliferation.

According to Gaucher, a papillomatosis at least exists histologically in the patches and is the starting-point of malignant transformation.

Sclerosis of the derma varies in intensity and often stands out in contrast with the thinness of the epithelial patch. It is hardly ever wanting and it even appears to precede the hyperkeratosis and is especially intense in leukokeratosis of luetic origin, being in these circumstances accompanied by occluding endarteritis. Now, as syphilis is a particularly sclerogenous process, the

sclerosis of the derma often precedes the epithelial hyperplasia, hence in syphilitic subjects the latter may be dependent upon two factors of irritation, *viz.*, a deep inflammatory one—sclerosis of the derma—and an external one realized by irritants and trauma of the mucosa. Thus the frequency of leukokeratosis in luetic subjects.

Like cutaneous papillomata, leukokeratosis may end in malignant transformation if the subject lives long enough. In reality, cancer is not a primary morbid process as it develops in a soil that has previously been altered by preëxisting tissue changes; it is the ultimate outcome of multiple preparatory, pathologic conditions. In the case under consideration the leukokeratosis is the preparatory condition; and as Menetrier well puts it, "Cancer is a cell proliferation belonging as such to all morbid conditions in which the normal function of cell multiplication has become involved." Hence leukokeratosis and cancer are merely two different phases of the same process, the former being the prelude to the latter.

In histologic specimens of long standing fissured patches of leukokeratosis, clinically doubtful, Lenoir has described two precursory signs of malignant change, *viz.*, (1) proliferation and changes of the cells of Malpighi's layer indicating an inflammatory process of the epidermis, and (2) granulo-fatty or colloid degeneration of these cells, with interposition of migratory cells and cell infiltration sometimes extending to the papillæ of the derma.

When epidermic globes are present cancer has fully developed, but before these appear there is an embryonal cell infiltration of the deep epithelial layers and an increase in size of the entire epithelial layer, as well as an increase in size of each of its component elements in particular. Such are the various characters that are to be searched for when a biopsy is done.

The indications for treatment of leukokeratosis are to be found in the nature of the lesion present and their pathology, the principal aim of the surgeon being to prevent cancerous evolution. In this, one is to be guided by the age, situation, aspect, extent and number of the patches. Unquestionably, a patch which has recently developed may at first be treated by medical measures, but if the patch is of long standing and offers suspicious characters surgical removal should not be delayed.

The clinical aspects of the patch are also to be considered. If the patch is distinctly defined and opalescent, lying on healthy mucosa without induration or pain, many local medical treatments may be essayed, but even if the patient is distinctly syphilitic with a positive Wassermann, our limited experience has led us to be very pessimistic as to any curative effects from even an intensive treatment with the arsenical preparations and Hg. The following case is illustrative:

A male, *æt.* thirty-six years, developed a patch of leukokeratosis on the left side of the dorsum of the tongue, measuring one centimetre in length by six millimetres broad, nineteen months following the initial lesion, therefore in the height of the secondary phase. This patch had developed in the centre

of a mucous patch. An intensive treatment with 914 (total amount injected in nine weeks = 5 grammes) and thirty intravenous injections of Hg cyanide had no effect on the leukokeratosis, while, strange to relate, as the mucous patch retrogressed the leukokeratotic patch became more manifest. For this reason, the lesion being localized and single, it was removed by free excision carried down to the muscle of the tongue.

The patient, a heavy smoker, was ordered to give up the use of tobacco in any form, which he did, and when seen three years after the excision no recurrence had taken place.

If, on the other hand, the patch is thick, squamous, ulcerated or painful, its removal should be at once undertaken. The extent and number of patches must also enter into consideration, because it is certain that the greater the extent the greater the probability of malignant change. It is also true that when once malignant transformation has ensued, it is relatively benign, and many surgeons have referred to the slow evolution. Nevertheless, this does not imply that time should be lost before complete surgical removal is resorted to.

When the patch is not too large and is single, free excision down to the muscle of the tongue is all that is required, but when there are several patches or when a considerable portion of the dorsum of the tongue is involved, then, to our mind, decortication is the only logical procedure, the following technic being the most satisfactory:

Regional anaesthesia is obtained by a perineural injection along the two lingual nerves with a 1 per cent. solution of novocaine to every 100 c.c., of which 10 drops of a 1:1000 solution of adrenalin are added.

Two silk anchor threads are passed transversally through the tongue not far from the tip and two others are passed at the base of the organ, one on the right, the other on the left of the lingual V. By traction on these anchor threads the tongue is completely extruded and held in position, clearly exposing the field of operation.

Two incisions are then made starting from the anterior extremities of the lingual V and are made to converge towards the median line *above* the lesions. By their union these incisions form a V with the apex pointing forward which circumscribes the healthy area of the dorsum of the tongue. A V-shaped incision is now made following the edge of the tongue. This marginal incision is carried backwards on both sides of the tongue until it joins the posterior ends of the first two incisions. The entire area comprised between the central V and the marginal U incisions must next be removed by decortication.

The mucosa is firmly caught with forceps and rapidly dissected off with scissors from the subjacent muscle with great ease. Bleeding is profuse but easily controlled.

On account of the great pliancy of the carneous body of the tongue all that is necessary is to suture the edges of the central mucous triangle to the external edge of the wound and further down to bring into approximation

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the edges of the tongue, thus rolling over the edges towards each other. When the sutures are completed the tongue presents an ungainly cylindro-conical shape and during the first few days following the interference there is some lingual tumefaction and a small submucous blood collection in the floor of the mouth, but within a week this hæmatoma will have disappeared.

In my ten cases primary union was effected in all, and after several weeks or months the tongue had become flattened out and assumed an almost normal shape. Naturally, the mucosa of the under surface of the organ being stretched, it covers the decorticated area, so that the latter will offer a smooth mucosa deprived of papillæ. The ranine veins are likewise drawn upwards and are to be seen on the edges of the tongue.

Mastication and deglutition become normal but gustation remains somewhat obtuse. Speech generally becomes quite perfect, although in two cases the patients continued to lisp.

LEUCOPLAKIA BUCCALIS

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THE first time that the existence of this rare condition was brought to the notice of the writer was in 1898, when he was called upon to review, "The Atlas of Syphilis and Venereal Diseases," by Franz Mraček.¹ In this Atlas, the following case was reported:

CASE I.—*Leucoplakia buccalis, involving the hard palate, showing elevated, coalescent papules* (Fig. 2). R. S., twenty-one years old, prostitute, admitted November 16, 1896. The patient was first infected in 1893, and has since been treated nine times for syphilis. Most of the relapses consisted in papular eruptions on the genitals. The present attack first attracted the patient's notice two weeks ago.

On the hard palate, stretching from the fossa behind the incisors to the soft palate, is a coalescent group of mulberry-like proliferations of hard, yet elastic consistence, somewhat lighter in color than the slightly inflamed mucous membrane of the surrounding parts. The edges of the soft palate and uvula are slightly thickened and distorted as the result of a former attack of the disease, which even now betrays itself by an infiltration on the edge of the soft palate and uvula. The vibrations of the pillars of the fauces during phonation are sluggish and irregular. Concomitant symptoms are found in flat, glistening papules, as large as a bean, on the labia majora, and in a general glandular enlargement.

Treatment.—Inunctions. The specific infiltrations disappeared, the proliferations on the hard palate subsided, and the mobility of the pillars became almost normal.

In this particular case there was a definite history of syphilis, and the writer believed from the context that leucoplakia buccalis was really a syphilitic lesion appearing in the mouth in relatively rare instances.

Several years passed before another published case attracted the attention of the writer. This also was reported by a German authority,² and was summarized as follows:

CASE II.—*Leucop'akia buccalis, involving the tongue. Associated with ulcerating papules* (Fig. 3). P. P., forty-nine years old. Has been treated as an outpatient. The patient says that four years ago she noticed fiery-red, isolated nodules in the tongue for the first time. Various remedies were tried, among them cauterization (with lunar caustic), which caused the nodules to disappear for a time, but they always recurred. A year ago they again appeared, and the patient underwent twenty inunctions, whereupon the eruption subsided. Two months ago the nodules began to develop again, and with them whitish, coalescent ulcers.

Present Condition.—The tongue is only slightly swollen; at the back the papillæ are still intact; the front is smooth and covered for the most part with a cloudy, whitish layer of epithelium. A discolored, slightly raised ulcer extends

¹Atlas of Syphilis and the Venereal Diseases, by Franz Mraček, of Vienna. W. B. Saunders, Philadelphia, 1898. Fig. 42-A, 1344-3819.

²Atlas of Syphilis and the Venereal Diseases, by Franz Mraček, of Vienna. W. B. Saunders, Philadelphia, 1898. Fig. 41-B, 1343-3818.

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across the tongue and along both margins, while a similar ulcer, as large as a pea, occupies the tip of the tongue a little to the left of the centre. The ulcers are slightly raised above the surface and surrounded by a sharply defined inflammatory border.

The submaxillary glands are hard and moderately swollen. Painful mastication.

After the patient had been treated for eight days, scar-formation began in the middle of the ulcer, which finally was converted into a whitish, epithelial hyperplasia.

In this case, also, there was a distinct history of syphilis, and in this case the syphilitic lesions of the mouth overshadowed the leucoplakia patches.

About the same time, in 1903, the following case was also noted:³

Case III.—*Leucoplasia (Psoriasis) Linguae* (Fig. 4). C. J., forty-nine years old. Under treatment for emphysema and pulmonary catarrh.

The patient has had various diseases. In 1872, he acquired a hard chancre, which was followed by eruptions on the skin and sores in the mouth.

With the exception of local remedies and river-baths the patient did not undergo any treatment for his disease. Lunar caustic, gargles, and precipitate ointments were the local remedies he employed.

The patient was formerly a heavy smoker; he worked on a freight train and smoked a cigar, or a pipe, day and night. In 1891, he noticed for the first time whitish vesicles on the tongue, which bled when they were opened with a pin. The present condition of the tongue the patient says he has noticed for the last eighteen months. He is thin, but not cachectic.

Present Condition.—The tongue is not perceptibly swollen; but the patient can only protrude it a little and with difficulty. The surface is white, moderately thickened, and divided into irregular islands by shallow grooves. These grooves do not appear to be due to contracting scars, but rather to correspond to the normal furrows in the tongue. On the other hand, the islands appear slightly raised, owing to the thickening of the epithelium and to the moderate inflammation



FIG. 1.—Leucoplakia of left cheek, Case IX.

³Atlas of Syphilis and the Venereal Diseases, by Franz Mracek, of Vienna. W. B. Saunders, Philadelphia, 1898. Fig. 42-B.

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which preceded their formation, described by the patient as "blisters." The tongue does not feel hard, and in its present condition is not painful. All delicate tactile sensibility is lost.

The chewing of highly seasoned food or sharp pieces of bread is apt to produce fissures, which, however, heal of their own accord in a few days. The epithelium of the buccal mucous membrane opposite the alveolar border is also somewhat cloudy, but not so thick as that of the tongue.

Submaxillary glands are not swollen. No demonstrable syphilitic symptoms.

The patient disappeared from observation, and the ultimate result is unknown.

In this case history it will be noted that the presence of syphilis could not be definitely shown. This exclusion in diagnosis was based upon the knowledge of syphilis as it then existed, but it must be remembered that at that

time the *spirochæte pallida* had not been discovered, and the Wassermann test was unknown.

In 1909, the writer's interest in the subject of leucoplakia was again stimulated as a result of a study of a fatal case of thrush,⁴ and the article by Mikulicz in his classical "Atlas der Krankheiten der Mundhöhle" gave much additional and valuable information in the matter of differential diagnosis of this condition, and of allied diseases, characterized by patches more or less snow white in appearance which appear in the buccal cavity of affected individuals.

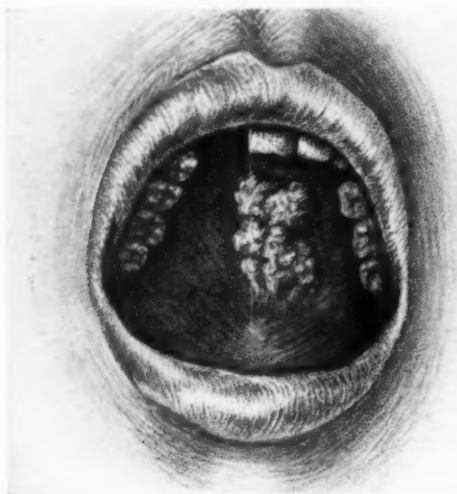


FIG. 2.—Leucoplakia of hard palate, Case I.

The illustration (Fig. 5) here shown is reproduced from the above-mentioned article.

In an attempt to review as far as possible all of the various articles in current medical literature, describing the condition of leucoplakia, it was found that such cases, while they are reported from time to time, are really of great relative rarity, and as lesions of this disease vary materially in different individuals, practically all of the cases available in medical literature are herewith collected for study and for comparison.

CASE IV.—*Leucoplakia of the tongue (Psoriasis Linguae)*.⁵ H. R., a merchant, fifty years of age, living in Eastern Prussia, was very nervous as a child and subject to epilepsy. As a young man he had frequent outbreaks of boils. In 1857, he acquired a syphilitic chancre and was subjected to a course of anti-syphilitic treatment. Later he suffered repeatedly from tumors and eruptions which healed

⁴ Thrush: A Clinical Study and Differential Diagnosis, by Henry P. de Forest, M.D., American Journal of Obstetrics, January, 1910.

⁵ Atlas der Krankheiten der Mund und Rachenhöhle. J. Mikulicz und P. Michelson, Berlin, August Hirschwald, 1892, Plate XXXI. (Fig. 3.)

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after using iodide of potash and mercurial preparations. Some years ago he had severe headaches, pressure in the eyes, and dimness of vision of the left eye. These symptoms disappeared after the use of iodide of potash. The same conditions redeveloped a year ago combined with loss of memory, sleeplessness, and complete inability for mental work. At this time the patient observed for the first time some painful spots in the left half of the tongue, while eating, speaking, or in any movement of the tongue. Examination with a mirror showed him some white spots on the dorsum of the tongue, which at that time had a well-marked border and gradually increased to the present extent.

In December, 1889, the patient came to the clinic of Doctor Mikulicz; his condition is shown by the illustration herewith presented. In the well-nourished, otherwise healthy patient, no other pathologic conditions could be detected. The urine showed no abnormalities and there was no evidence of an active syphilis. Upon the trunk and the extremities were a number of large and small pigmented scars for the most part quite superficial. On the dorsum of the tongue, as shown in the illustration, there existed an irregular network of broad and narrow snow-white streaks, enclosing small islands of mucous membrane, more or less ruddy in appearance. The entire tongue has a dull surface and as a result the diseased portion is easily distinguished from the adjacent normal mucous membrane. The borders between the normal and the milk white mucous membrane are indistinct. The affected portion is more sensitive to slight motion than to firm pressure. The greatest pain is felt on the border of the tongue.



FIG. 3.—Leucoplakia of tongue, Case II.

Palpation discloses no difference in the consistence of the various portions of the organ. The patient formerly smoked a great deal. He has been hard of hearing for twelve years.

Treatment.—Iodide of potassium and bromide of soda were given internally, one gram daily. Local treatment consisted of painting with a cocaine solution and with frequent cleansing of the mouth with a mild antiseptic. In the course of treatment of about two months, the appearances almost completely disappeared. The patient felt himself mentally and bodily quite restored to health. The condition would improve or grow worse from time to time and occasionally superficial excoriations would occur which were quite painful. These raw spots healed, as a rule, in the course of from one to two weeks. The healing was hastened by a daily penciling with blue vitriol. At the end of July, 1890, the local condition remained practically unchanged.

CASE V.—*Leucoplakia of the tongue (Psoriasis Linguae).*⁶ K. K., a merchant, sixty-two years old, otherwise healthy. For a number of years there slowly developed a series of white patches upon the dorsum of his tongue. At the beginning the patient had no distress and paid little attention to this condition. During the last

⁶ Atlas der Krankheiten der Mund und Rachenhöhle. J. Mikulicz und P. Michelson. Berlin, August Hirschwald, 1892. Plate XXXI. (Fig. 2.)

two or three years he suffered from a more or less well-marked painful sensation in the left half of the tongue. Movement, or even firm pressure of the tongue, was not painful, but while speaking or eating with ordinary movements of the tongue, he noticed a painful spot in it. Frequently the pain began spontaneously, especially when the patient was alone. When in the company of others, as a rule, he forgot his distress. The patient is a well-marked hypochondriac, and when otherwise unemployed, thinks chiefly of his condition and imagines that it indicates all possible ailments. He has consulted numerous physicians; has tried various remedies and cures without permanent relief. Unfortunately there is no record in history of the case, whether he was syphilitic, or whether he smoked to excess.

On the 7th of February, 1889, he came to the Clinic of Doctor Mikulicz for the first time. He was well nourished, did not show his age, and showed no other pathologic changes. Upon the dorsum of the somewhat broadened tongue appeared the patches well shown in the illustrations. They are of milk-white color and are



FIG. 4.—Leucoplakia of tongue, Case III.

divided by numerous well-marked dark colored lines and streaks. The surface is dull and sharply differentiated from the neighboring normal epithelium. If the finger be passed lightly over the surface of the growth, the rough velvety surface of the affected portion of the mucous membrane is distinctly felt. On the more horny portions of the growth there is no especial difference to be felt in the consistence. Both sides of the tongue show light impressions of the outline of the teeth. This is accounted for by the fact that the patient believes that absolute immobility of his tongue is necessary for his comfort.

The further course and treatment of the disease is not indicated.

CASE VI.—*Leucoplakia buccalis* (Fig. 5).⁷ R. R., forty years old, a merchant in Russian Poland, acquired syphilis when sixteen years of age. Four years ago he observed for the first time white spots on the top of the tongue which gradually increased in circumference and later similar spots appeared upon the mucous membrane of the cheek and lower lip. At the beginning this patient had no distress. But in the last few years he experienced a sharp burning pain on the left border of the tongue which increased during speaking or chewing. Since that time the patient has developed a marked hypochondriac voice. All treatment, both local and systemic, including anti-syphilitic cures, have been of no assistance. The patient smokes strong cigarettes to excess (about fifty a day). He drinks brandy also to excess.

At the time of the preparation of the accompanying plate in March, 1890, he was a well-built, well-nourished man with little to be observed, aside from the changes in the mucous membrane of the mouth. There are no other evidences of syphilis. The patches in the mouth are snow-white, of a dull surface, rather thin, and showing the color of the mucous membrane through them. Some are large,

⁷Atlas der Krankheiten der Mund und Rachenhöhle. J. Mikulicz und P. Michelson, Berlin, August Hirschwald, 1892, Table XVI. (Fig. 1.)

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some are small, and some are confluent. They are distributed irregularly upon both borders of the tongue and upon its dorsum. The portions of mucous membrane between the patches are hyperæmic. A discoloration, with poorly defined edges, exists upon the mucous membrane of the cheeks and lips, in an almost symmetrical form on both sides. This is most pronounced at the angle of the mouth where there is a well-marked centre with radiating streaks. There are a number of small millet-seed patches upon the mucous membrane of the lower lip. The left side of the tongue is sensitive to motion. In the remaining portions of the affected mucous membrane, sensation is diminished.

Treatment.—The patches were painted with cocaine and boro-glycerine solution. Thermo-cautery was used thoroughly over the painful area on the side of the tongue. The ultimate outcome of this case is unknown.

CASE VII.—

Epithelioma of the tongue with hair-like hypertrophied papillæ following a leucoplakia of the tongue; twenty years' standing (Fig. 7).^{}* K. S., sixty years old, a post-master in Austrian Silesia. In good general health. He formerly smoked to

excess, but denied the excessive use of alcohol. For the past twenty years the dorsum of the tongue has shown a number of white horny patches which caused no particular disturbance. Now and then he felt a moderate burning of the tongue. A few weeks ago a growth developed in the anterior portion of the left border of the tongue. This he believes was due to a sharp corner of a broken tooth. The growth gradually increased in size and finally reached its present condition. With this exception the patient complains of no other illness.

On the 14th of March, 1886, he entered the Clinic of Professor Billroth in Vienna. He was a powerful man in good condition for his years. On the tip of the tongue was a well-marked tumor represented in the illustration. It appears as an irregular nodular thickening of the tip of the tongue, ulcerated in several places. A considerable portion of the growth was covered with a milk-white layer of epithelium. Its most pronounced characteristic was the appearance of the tremendously increased growth of the papillæ of the tongue (5 to 15 mm. long)

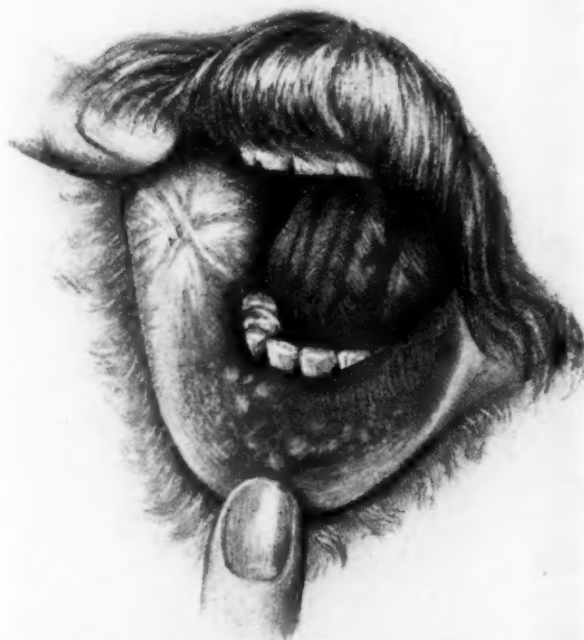


FIG. 5.—Leucoplakia of the right cheek, Case VI.

^{*} Atlas der Krankheiten der Mund und Rachenhöhle. J. Mikulicz und P. Michelson. Berlin, August Hirschwald, 1892, Plate XXXI. (Fig. 1.)

which surrounded like a white moustache the posterior and right border of the tumor. The larger portion of the dorsum of the tongue was covered by a thick milk-white, dull epithelial layer. The examining finger could feel a well-marked nodular tumor occupying the anterior third of the tongue in its central portion. The other portions of the mouth showed nothing abnormal; the glands were not enlarged.

On the 22nd of March, the diseased portion of the tongue was excised and the wound completely sutured. The healing was uneventful. The further fate of the patient is unknown.

The microscopical examination showed a squamous-celled epithelioma. The elongated papillae arose from a basal structure of connective tissue from one to two millimetres thick. The epithelial growth extended between the papillae into the structure of the tongue itself. This illustration is taken from the records of Professor Billroth.



FIG. 6.—Leucoplakia oris (psoriasis linguae, tylosis, ichthyosis buccalis), Case IV.

and ending with a more severe form, in which cancer is combined with leucoplakia. The ultimate outcome of this unfortunate combination is not necessarily fatal. In the case illustration, Fig. 8, a cancer of the left half of the tongue existed, combined with leucoplakia and bilateral cervical adenopathy. The cervical and buccal lesions were removed in two sittings. The small glands on the right side were unfortunately left in place. Fulguration, March 21, 1909. The patient was cured for nearly three years. The source of this case report is unknown, but it was obtained in recent medical literature.

A careful study of this series of cases, which, though not numerous, epitomize practically all of the cases that have been reported in current medical literature for the past thirty years, discloses certain facts which are worthy of more careful and detailed consideration.

Synonyms.—The disease itself, although it has been recognized and described by a number of writers, has never until recent years been given a

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definite and well-recognized name. It has been variously described under the following titles:

Leucoplakia buccalis, psoriasis linguæ, tylosis oris, buccal keratosis, ichthyosis buccalis, plaques nacrées, chronic superficial glossitis, leukonia, raucherplaques, plaquesnarben, lingual psoriasis, epithelial white plaques of the tongue.

The present title of leucoplakia buccalis appears to have been first suggested by Merklen at the Congress of London in 1881, and was accepted by *Hillairet*, *Kaposi*, *Vidal Clément*, *Duncan Bulkley*, *Behrond* and *Wilson*. Two years later it was taken as the title of an article by *Leloir*, and since then it has been incorporated and accepted in current medical nomenclature. The other designations above mentioned have been proposed both before and after 1881, but have not been generally adopted. Each name represents an attempt on the part of the person proposing it to describe the salient feature and real nature of the disease. To enumerate them is to trace the history of the different opinions which have been expressed.

Schwimmer proposed the name of "White Plaques of the Mouth." This is mentioned for the sake of completeness, for it is merely a synonym of leucoplakia buccalis.

Definition.—Leucoplakia may be defined as a chronic and progressive affection of the mouth, characterized by the occurrence upon the mucous membrane of snow-white patches, sometimes circumscribed, sometimes diffused.

Historical Sketch.—Bazin, in 1868, in his "Leçon Clinique," described the disease under the name of "Lingual Psoriasis," and made a study of this condition which has remained classic. Without giving the name "Psoriasis" the exact meaning which really belongs to it, he believed it to be a constant accompaniment of arthritis. In 1878, Deboe in a thesis, and Mauriac in an



FIG. 7.—Leucoplakia of tongue with epithelioma, Case VII.

important article, without agreeing with the ideas of Bazin as to the nature of the disease used the term "Psoriasis," which gives a good idea of the general aspect of the lesion and is not ambiguous. The English school, impressed particularly by the hardness assumed by the mucous membrane, becoming as Hulke says, like kid leather, proposed the name of ichthyosis, which was adopted by Clark and by Morris, and has persisted up to the present time. Before this time, Clark had attempted to make London physicians accept the term, tylosis linguæ. This was rejected by the English, but was accepted by Ullmann of Germany, and by Lallier of France. This title has since been given up. Devergie, in 1876, without success, proposed the name

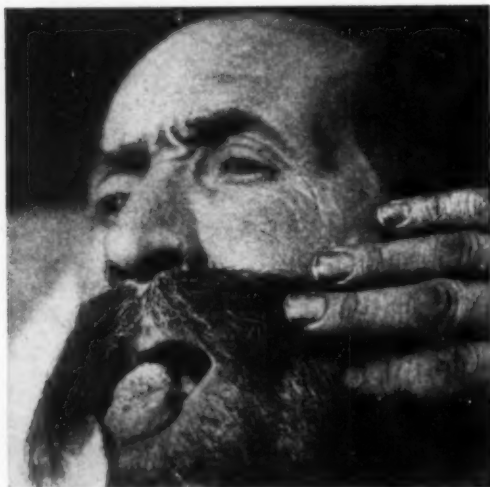


FIG. 8.—Cancer of the left half of the tongue, with leucoplakia and bilateral cervical adenopathy. Removal in two sittings of the cervical and buccal lesions. The small glands on the right side were left in place (unfortunately). Fulguration, March 21, 1909. Cured for nearly three years.

of epithelial white plaques of the tongue. Recently Doyon and Besnier have been equally unsuccessful in regard to the terms, chronic epithelial glossitis, and buccal keratosis.

This disease which has been described under so many different names, and which we shall hereafter refer to as leucoplakia buccalis, has an obscure history. This is due, not only to the various terms under which it has been described and the dissimilar ideas expressed in regard to its pathogenesis, but also to the fact that it has a varied etiology, and under this name many inflammatory conditions of the tongue have been included which look

alike but which are in reality totally different in character.

Etiology.—The etiology of this disease is in part still obscure. It is certain that the predisposition to abnormal tenderness and the lack of resistance of the mucous membrane may cause irritation of the oral cavity.

Leucoplakia buccalis is essentially a disease of adults. So far as age is concerned, it is most frequent in the fifth or sixth decade of life; it rarely occurs before the fortieth year. It is a rare occurrence in women (one to sixteen, according to Clark, and one to thirty-five, according to Leloir). According to Deboe, it exists only in men.

It is described by some writers as an occupational disease: "The White Plaques of Glass-Blowers." Still other writers have regarded it as a constitutional disturbance. Arthritis and a variety of herpes seem to play an important rôle in the causation of a number of cases. Anæmia, consumption, diabetes, or any disturbance of digestion may be factors in the etiology.

Leucoplakia has been noted in connection with special irritative conditions

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of the digestive tract, such as dilatation of the stomach. In some instances it appears to have developed as a result of the irritation of the tongue, due to faulty dentition, or sharp corners of broken teeth. The habitual use of alcohol is an undoubted factor and so also is the use of highly spiced and irritating foods and condiments. Protracted medication with such drugs as the mercurials or the iodides are predisposing causes. So, also, is the habitual inhalation of smoke and dust.

The principal cause is undoubtedly the smoking of many and strong cigars or cigarettes, or the use of tobacco in short-stemmed pipes. The nicotine of tobacco is not the only cause, but the combustion products of the tobacco, such as carbonic acid gas, ammonia, creasote. All empyreumatic oils are especially irritating.

This fact accounts for the much greater preponderance of leucoplakia in men than in women, for it has been observed that in those countries where women also smoke to excess, leucoplakia occurs equally in both sexes.

Many writers have regarded this disease as habitually depending upon the former syphilitic affection, and therefore have described it as a symptom of syphilis. This view does not seem to be supported. The carefully compiled statistics of Erb and of Neisser show that in a large number of typical cases of leucoplakia, syphilis could be excluded. Especially convincing in this particular are the number of cases observed in which a patient who had suffered from long-standing leucoplakia had developed a primary syphilitic lesion with the secondary symptoms appearing in due time. If the disease of the mucous membrane were of specific origin, the patient would then be immune against a new syphilitic affection. The resistance of leucoplakia to ordinary anti-syphilitic treatment, also supports the belief that it is not due to this disease. If leucoplakia really exists, it is made worse by such treatment. Mercury appears to be without effect, though there is a slight filling of the mucous membrane as a result of its use, and there is no doubt that the long-continued use of mercury, of the iodides alone, or of both together, tends to irritate the mucous membrane, and possibly produce a variety of leucoplakia. That these growths do not go on to the thick and horny formation of other forms is because the injury caused by mercury is a transitory one. When it is no more needed its use is stopped, while smoking and drinking are, in many instances, continued throughout the entire life.

If, however, syphilis is not to be regarded as a direct cause of leucoplakia, there is no doubt that it is an important predisposing factor in the occurrence of this condition. Schoengarth published a list of all the hitherto reported cases of leucoplakia which he could collect; 65 per cent. show a syphilitic history. The great improvement made recently in the accurate diagnosis of syphilis by the Wassermann test will unquestionably do much to eliminate syphilis as a causative factor in many cases where its existence was formerly suspected but could neither be verified nor excluded. All authors have agreed that leucoplakia is an extremely rare occurrence in women, though syphilis, of course, occurs in practically the same number of women as in men.

Tobacco and syphilis must be regarded as the most important factors in etiology. Where syphilis exists it is probably true that less smoking is necessary to develop leucoplakia. Erb is right when he says that unless these two causes are present, leucoplakia is rarely found.

Symptomatology.—The symptoms of this disease are usually quite evident. There appear to be two fairly well marked clinical forms of leucoplakia. The *undeveloped form* and the *common form*.

The *undeveloped form* has been thoroughly studied by Benard. This usually occurs in patients suffering from gout or arthritis, and particularly in persons who are excessive smokers. Its beginning is very insidious. Its advance slow, almost imperceptible. It is accompanied by almost no disturbances. On examination of the mouth, particularly the tongue, a slight turgescence of the papillae is noticed, accompanied by a hyperaemia of the mucous membrane. The normal furrows of the tongue are markedly accentuated. This is the so-called "Parquet" tongue, characteristic of gouty people; it may persist for years. Gradually the tongue becomes gray and then white. At this stage where hypertrophy of the papillae is much more evident, each one of them is covered with thick epithelium, and examination shows that the pearly-white coloration is found only at the base of the inter-papillary furrows. This intermediary stage may persist for months or years; finally a light desquamation takes place, small superficial ulcers are formed, and true fissures develop in place of the furrows. At all stages of this type of the disease, the treatment of the coexistent constitutional condition produces an amelioration of the local affection.

In the common form the symptoms are much more typical. There are often pronounced functional disturbances, stiffness of the tongue, difficulty of speech, mastication and swallowing. Later ulcers and fissures develop, finally accompanied by pain. Salivation and an occasional hemorrhage occur, due to tearing of the tissues underlying the base of the deep fissures. The lesions exist in very irregular patches. They are grayish-white, pure white or sometimes of a glistening iridescent white, suggesting mother of pearl (*plaques nacrées*, Fournier).

Clinically these areas appear as quite smooth, dry, milk-white patches, hence the name. The more recent layers of epithelial thickening are relatively thin, show a more rosy-red color, and are not sharply separated from the surrounding tissue. The affected spot appears as if the mucous membrane had been slightly touched with nitrate of silver, or lunar caustic. Through the thin whitish layer, the normal red of the mucous membrane is visible. The older masses appear as thick rinds and are of a pure white or bluish-white color. These masses are for the most part sharply differentiated from the adjacent mucous membrane, and there is frequently an inflamed red border surrounding them, less than 1 mm. wide. As time goes on these rinds become progressively thicker, and more like leather. They are markedly raised and as a result are easily torn free from the underlying tissue by mechanical means such as the teeth, the movements of the tongue or

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hard particles of food. Fissures of the superficial tissues develop, extending deep into the tissue of the tongue itself. Slight hemorrhages occur from accidental causes, and the rinds then assume yellowish or brownish colors, which are transitory, for the white color reappears as soon as the blood is reabsorbed.

As a rule leucoplakia is limited to the anterior portion of the dorsum of the tongue, either at the tip, or upon its borders where are found patches, large or small, isolated or coalescent. The upper surface of the tongue as the result of this growth, presents a peculiar faceted appearance, though, as a rule, the outlines are quite irregular, especially when new growths are interposed between those of long standing.

Infrequently similar growths appear on the inner surface of the cheeks and lips. A characteristic growth often appears at the junction of the upper and lower lip where leucoplakial streaks may radiate from the angle of the mouth in a fan-like fashion. If the lips themselves are involved, the growth progressively diminishes toward the vermilion border. More rarely it attacks the hard and soft palate. The gums and alveolar processes are almost never involved.

Fissures appear most frequently upon the surface of the tongue itself, since this organ is most apt to be injured by mechanical means as a direct result of its mobility and function.

If the patches themselves are subjected to a microscopic examination, it is found that the pavement epithelial cells of the white patches are more or less enlarged and thickened, the submucosa is filled with lymphoid cells; the blood-vessels are increased, dilated and surrounded by a small-celled infiltration. When the growth has persisted for some time, a horny thickening of the superficial epithelia takes place, oftentimes accompanied by a marked increase in the size and length of the papillæ. In the lower layer of the epithelium there is a marked stratification of the cells and a sort of cup-like formation of the nuclei in the midst of this horny epithelial layer. A peculiar substance, eleidin, appears to be produced as a result of the horny changes in the epithelium.

The *pathological anatomy* of these growths was exhaustively studied by Leloir, who notes three successive phases of development.

First, the hyperkeratinization of the mucous membrane which becomes horny, hypertrophied, and shows a granular layer rich in creatin or eleidin. This layer then swells and becomes very large as a result of this thickening of the horny layer.

Second, the formation of ulcers, as the result of this excessive hardening. These take the form of fissures within the plaques themselves, and around their edges. These fissures extend completely through the mucous membrane as far as the papillæ and as a result cause inflammatory lesions, exfoliation, desquamation and infiltration. A pronounced change in the submucous glands may also develop.

Third, the last phase shows a thickening and hardening of the dura around

the plaques. Sclerotic atrophy of the blood-vessels with dis-association, compression and atrophy of the muscular fibres occur. In this stage the underlying tissues may be involved, disintegrate, and favor the invasion of agents leading to the formation of epitheliomata. Upon the edges of the organ, deep indurations may develop, sometimes very painful and accompanied by rapidly developing adenopathy. If the usual form of cancer of the tongue develops, it progresses with its usual malignity, though certain cases have been observed in which an early excision of the cancerous growth appears to have been followed by permanent cure. In the later and more marked development where cancerous changes do not occur, the papillæ form warty, spinous or shield-like prominences, still preserving their sharply marked outlines.

As a general rule there are found at this stage torn furrows, and gaping rhagades appear on the lips and on the tongue, that is in those parts where, as a result of their musculature, movements are most pronounced. These patches do not change into ulcers. Papillomatous growths on the borders or in the fissures of the patches are occasionally observed, not unlike a chicken's comb in appearance.

A similar discoloration of the epithelium has been observed upon the mucous membrane of the vulva of the uterus and even of the kidneys. In rare instances it has been observed in the skin eruptions of psoriasis and in lichen planus.

The subjective manifestations vary materially in different patients. In the greater number of cases in the early stage of the disease, there is almost no discomfort, and the trouble not infrequently is discovered only as a result of a feeling of an annoying burning of the mucous membrane of the mouth, or of the sensation that a foreign body is lying upon the surface of the tongue or cheeks which needs to be removed. An examination by the patient with a mirror is then made and the incipient leucoplakial patches are discovered. There may be great sensitiveness in speaking, eating, drinking or smoking. The use of spiced foods or of alcoholic drinks often causes especial irritation. In the later stages when the thickened and horny condition of the epithelium has developed, there may be but little distress except the discomfort complained of from the stiffness and difficulty in moving the tongue and lips, in chewing or in speaking. If the epithelium be distorted to a large extent by furrows, ulcerated fissures, pronounced excrescences or carcinomatous infiltrations, the affection may become very painful. In such cases hemorrhages often occur. The alteration in taste or in salivation is rarely observed unless the disease is extensively developed.

Diagnosis.—The detailed account of the lesions observed and the symptoms to which they give rise, described in the preceding section, should make the diagnosis of this disease a matter of comparative ease and certainty.

In view of the fact that syphilis has played such an important rôle in considerably more than half of all of the cases of leucoplakia which have been reported, the positive exclusion of this disease or confirmation of its existence should always be made by means of the Wassermann test.

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If a man be suffering from syphilis, he often regards these patches as a manifestation of that disease. Other patients believe that cancer is about to develop. These two conditions are generally regarded by the laity with great apprehension, and therefore many patients with leucoplakia become hypochondriacs upon this subject. They magnify their symptoms of discomfort in the mouth and attribute to the disease much greater importance than really attaches to it. There is a real reason for anxiety, however, for in not a few cases in which leucoplakia was first observed an epithelioma of the tongue developed later, but it is not always easy to determine whether the cancerous growth took its origin in the leucoplakial patch or in some other local irritation of the organ. The same causes of irritation of the tongue and mucous membrane favor the development of this form of carcinoma quite as well as of leucoplakia itself. It would be quite erroneous to maintain that every case of leucoplakia ultimately terminates in carcinoma. Moderate degrees of leucoplakia are far more frequently seen than severe cases of the disease, and in many cases the condition remains stationary for years, even for decades. We must admit in view of the number of cases of leucoplakia which have been reported in which epitheliomata subsequently developed that this disease may be regarded as a predisposing factor in the formation of cancer of the tongue. The extreme degree of mental apprehension, hypochondriasis, or well-marked neurasthenia, which have been observed in severe cases of leucoplakia, should of themselves be regarded as important factors in an accurate diagnosis of this disease.

The illustrations selected show well the various stages of the disease in various localities of the oral cavity, and should greatly facilitate or confirm the diagnosis.

Differential Diagnosis.—Certain diseases of the mouth always give rise to white patches upon the mucous membrane. No one unfamiliar with the classical "Atlas of Mikulicz" can realize that an entire volume may well be devoted to the diseases of the mouth alone. Many of these diseases differ materially in their clinical appearance from the lesions of leucoplakia, but certain ones are to be borne in mind where any question of diagnosis arises.

In infancy, thrush, acute gonorrhœal stomatitis, Bednar's aphthæ (Bednar's plaques, *ulcera pterygoidea palati*) are most frequently observed. The age of the patient alone should serve to differentiate these conditions from leucoplakia, although thrush also occurs in adults.

In the adult, the three conditions most apt to be confused clinically with the disease under discussion are those of aphthous stomatitis and chronic recurrent aphthæ. The clinical history of these diseases is quite characteristic.

Acute papular glossitis, an extremely rare disease, more closely simulates leucoplakia buccalis so far as the pure white color is concerned than any other buccal affection, but the shape of the lesion with a depressed centre and a snow-white periphery easily serves to differentiate the two conditions. The article of the writer upon "Thrush," which has already been mentioned, gives further details of differential diagnosis.

Another disease in the adult with which leucoplakia may sometimes be confused is tuberculosis of the tongue. This disease is also extremely rare in the buccal cavity, but the possibility of its occurrence must always be borne in mind.

As a rule the form of tuberculosis which develops is of a non-malignant type and oftentimes, though chronic in its course, can be cured by the use of superficial thermo-cautery combined with the administration of iodide of potassium internally. The growth itself is not of the silvery white observed in leucoplakia, but has a greenish tint and tends to ulceration. A number of excellent illustrations of this condition may be found in the volume of Mikulicz already cited.

Miliary tuberculosis of the tongue may develop which resembles leucoplakia much more closely than the ulcerative form just mentioned.

It is also possible to confuse leucoplakia with lichen-ruber planus. In this growth there are occasionally found smaller and larger isolated or confluent white patches on the lips, cheeks, tongue, gums and soft palate which appear very similar to the leucoplakial growth. According to Touton, the group-like formation of the patches and the net-like streaks, as well as the formation of definite nodes and the simultaneous or shortly following affection of the outer skin, serves to distinguish them. The internal use of arsenic combined with the local application of corrosive sublimate rapidly cures the lichen planus, while leucoplakia is practically unaffected by this treatment.

Most important of all in the differential diagnosis is the fact that certain lesions of the papular form of syphilis which occur in the oral cavity sometimes closely simulate in general outline the growths of leucoplakia. The persistence of the patches in true leucoplakia is an especial characteristic; they remain for months at a time at one and the same place in spite of all treatment, whereas the syphilitic papules as well as benign growths remain for a much shorter period in any one place, and either extend their borders rapidly or heal. Although the leucoplakial patches never change into ulcers though fissures may sometimes develop, the syphilitic patches after a short time usually become superficial ulcers. The leucoplakial growths with the passage of time become steadily harder, more resistant, and finally, warty or horny; the syphilitic growths soon coalesce and become slightly coherent and soft. Syphilitic patches heal with relative promptness under general and local treatment without scars, whereas leucoplakia is rarely influenced by the use of mercury or iodine; in any event there always remains a depressed central scar.

To add to this confusion certain forms of syphilides, particularly of the large macular variety, show first a roseola which may disappear without leaving any appreciable change in the skin, or on the other hand, in rare instances, a slight, barely noticeable desquamation of the epidermis in the affected areas occurs after the disappearance of the eruption. More frequently the pigmentation disappears, so that the affected parts appear white and lead to the formation of cutaneous leukoplasia, though the pigment disappears in

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the centre of the eruption it may be increased around its periphery. This is particularly the case in parts naturally rich in pigment, as the nape of the neck and the genital region. Occasionally the entire surface of the body is thickly covered with pale, non-pigmented, circular or oval spots. This so-called syphilitic leukoplasia is a more valuable sign than any other, as it may represent the remains of a cutaneous syphilide of very long standing and form a diagnostic point of the highest importance in doubtful cases of diseased organs.

The mucous membrane of the oral cavity is almost always involved during the secondary period of syphilis. Papular ulcers and fissures are constantly found. The alterations which are produced in the tertiary stage are known as *syphilitic pachydermata* or *psoriasis mucosæ oris*; they occur in the mucous membrane of the tongue, the cheeks, especially opposite the teeth, and in several other localities. The characteristic sign is a thickening of the mucous membrane with the formation of whitish patches consisting of several layers of proliferated epithelium almost as hard and horny as the skin.

There is scarcely an organ in the body in which syphilis deposits so many and such various pathologic products as in the tongue. The later stages of secondary syphilis are often marked by papular eruptions and ulcerations along the margin of the tongue and by extensive infiltrations on its surface. Among the tertiary forms some writers include so-called psoriasis or leukoplasia of the tongue. These facts have been so long observed in connection with syphilis and the terminology employed is so similar to that of leucoplakia, that there is little doubt that much confusion has occurred in the accurate diagnosis of these similar conditions of the mouth. In many instances there is no doubt that leucoplakia and syphilis have co-existed. In other cases leucoplakia has been regarded as a late syphilitic manifestation. At the present time this confusion can easily be avoided by the routine use of the Wassermann test in all cases of leucoplakia which come under observation.

The case herewith submitted of leukoplasia is taken from Mraček.⁹

CASE VIII (Fig. 9).—*Leukoplasia of the neck. Papules on the genitalia.*
A. B., eighteen years old, servant girl. Has never had a venereal disease. In the beginning of December, 1895, she began to be troubled with burning during micturition; at the same time several "pustules" developed on the outside of the labia majora, which burst after several days and healed over. There was also a painful swelling of the right inguinal glands, lasting several weeks and disappearing finally after rest in bed and the use of compresses. In February, 1896, she was troubled with pain in the throat, and for two weeks was unable to swallow solid food. These symptoms improved after gargling with alum. A few days afterward an erythematous eruption appeared on the throat, on the flexor surface of both elbows, and on both legs. Since the end of March the eruption has been brown. On May 23 she came under hospital treatment; up to that time she had not consulted a physician. Last coitus six months ago; last menstruation, April 29. Has never given birth, nor had an abortion.

Present Condition.—Eroded, œdematous papules on both large and small labia, especially on the right side; inguinal glands on both sides much enlarged; at the

⁹ Atlas of Syphilis and the Venereal Diseases, by Franz Mraček, Vienna. W. B. Saunders, Philadelphia, 1898.

anus the mark of an old papule. On the lower extremities a specific eruption in process of regeneration; intense leukoplasia of the neck; both tonsils enlarged and ulcerated.

Cured after twenty inunctions. (See Fig. 9.)

With this history it is little wonder that with the characteristic white spots on the body confusion in diagnosis could easily occur if similar white areas appeared in the buccal cavity.

Prognosis.—The course of leukoplakia is always a very chronic one; it may become limited in its growth within a few months, or may persist for



FIG. 9.—Leukoplasia of the neck. Papules on the genitalia, Case VIII.

ten, twenty or thirty years; indeed, throughout life. More frequently there are periods of activity, alternating with periods of quiescence and excess in smoking not infrequently causes a desquama-

tion of the epithelial masses. Prognosis, except in cases where syphilis co-exists and mercury is of help, is very doubtful. Leucoplakia often occurs without material discomfort, and occasionally is cured spontaneously. On the other hand, a permanent cure is the exception. The prognosis therefore is dubious. According to Schuchardt, any chronic irritant affecting either the skin or mucous membrane by producing an increased vascularization of the tissue favors the formation of cancer. The presence of leucoplakial patches in the mouth, therefore, increases the liability to this unfortunate termination. Even if excision of the cancerous growth performed at an early stage, recurrence is frequent. The occurrence of carcinomata in leucoplakia deposits, though it sometimes does happen, cannot be regarded as the rule.

It is possible that the treatment practiced and advocated by the writer and described later in this paper may materially affect the prognosis of this disease.

Treatment.—When the clinical history of a case of leucoplakia is carefully considered it is apparent that the prophylaxis is quite as important as the

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administration of medicine or any local treatment which promises to relieve the condition.

The preventive treatment which should be at once begun is self-evident from the clinical history of the disease. The use of tobacco in all forms must be stopped. Most patients themselves observe that with the cessation of smoking their trouble is materially improved, and if they begin again it is made worse. It is a severe punishment for a confirmed smoker to give up this habit, particularly because of the appearance of an apparently harmless disease, so in most cases the best we can do is to limit the daily number of cigars or cigarettes, and to recommend the habitual use of a long cigar-holder. Short pipes must be prohibited. It must not be forgotten that tobacco juice is also a powerful irritant to mucous membranes so that chewing tobacco must also be forbidden. If possible, after a progressive diminution in the use of tobacco, its use in any form should be entirely discontinued.

The use of mercury must be excluded as well as any irritation of the mouth by acid, acrid or irritating foods, drinks or spices.

If the teeth are broken or decayed, pointed useless roots should be extracted and the cavities filled. In fact, all causes of irritation of the mucous membrane of the mouth are to be removed.

Dyspeptic disturbances, consumption and anæmia must all be cared for according to their respective needs. Anti-syphilitic treatment is not only unnecessary, but even harmful as Erb early maintained. This, of course, presupposes the fact that the existence of syphilis has been excluded by the Wassermann test.

Unfortunately the disease is very resistant to treatment, and as is usually the case in diseases of obscure etiology, many local applications have been recommended. In the milder cases, antiseptic and slightly astringent mouth-washes can be used to keep the mucous membrane in good condition and to allay the patient's apprehensions. Tincture of myrrh, tincture of nutgalls flavored with a drop or two of oil of peppermint, peroxide of hydrogen, and similar medications can be tried. No one of these should be continued too long as the taste of the patient varies materially from time to time. The treatment of single patches of leucoplakia in obstinate cases is best done by means of caustics. Pure lunar caustic, a 50 per cent. solution of nitrate of silver, a 5 per cent. solution of lactic acid gradually increased to 50 per cent., chromic acid solutions, and, more recently, concentrated preparations of peroxide of hydrogen, are all to be recommended. Salicylic acid is of value to aid in the dissolving and softening of the mucous membrane. A 2 per cent. solution of resorcin has been used. Rosenberg recommends the painting of the patches with pure balsam of Peru, allowing it to stay in the mouth for from three to five minutes.

Unfortunately in most cases, this entire list of medication proves to be of no value, and often this very lack of result confirms the patient in his belief that he has an incurable disease which will ultimately end in cancer. Many cases therefore give rise to a severe form of hypochondriasis, although, as a

rule, the patient suffers but little discomfort. If speaking, eating, and drinking are interfered with, mental disturbance is still more apt to occur.

Some writers advocate that as soon as the patches of leucoplakia develop to any extent, they should be thoroughly curetted away and the base cauterized with the thermocautery. Or the tip of the tongue can be firmly grasped in a bit of gauze and with a sharp scalpel the patch of leucoplakia can be shaved off exactly as the skin is removed for transplantation.

Rinschoff gives preference to the procedure of decortication of the skin after first sprinkling the affected areas with crystals of permanganate of potash. After this procedure there is often left in place of the sensitive rind a soft insensitive scar. Such a procedure can hardly be necessary in patches of small size, but at any rate it prevents the later development of larger growths. The effect upon the patient's mental condition of the absolute removal of the growths by any of these procedures is usually a salutary one if the treatment be successful. On the other hand, if it be unsuccessful, these procedures only make the mental attitude of the patient worse. One is certainly justified in regarding the condition as harmless as long as the area of the lesion is not extensive.

The possibility of the ultimate development of an epithelioma should in all cases be stated to the patient, and if such a growth begins to develop, radical surgical procedures should be at once instituted.

This in its essentials indicates the line of treatment which has been pursued by many physicians at many times. The very fact that such a large number of remedies have been suggested indicates the little knowledge which we possess as to the true cause of the disease and the uncertainty of all forms of treatment that have been mentioned.

Personal Observations.—Up to the time that I prepared my article on "Thrush," the subject of leucoplakia to me had but an academic interest. No case of the disease had ever come under my observation, and in view of its extreme rarity, it seemed improbable that I should ever be called upon to care for a patient suffering from this disease. On June 9, 1911, however, there was referred to me by Dr. Francis J. Magilligan, of Brooklyn, a patient whose history was a typical one. The result of treatment, involving as it did certain phases of medication, never before used, so far as I am aware, quite surpassed all reasonable expectations.

CASE IX (Fig. 1).—J. O. S., a native of Ireland, sixty-three years of age, a former member of the Police Department of this city. Family history negative. His mother died in childbirth; his father, at the age of eighty-two.

Personal History.—He formerly chewed a package of tobacco a day, and he himself concluded that this caused the onset of his trouble. He stopped chewing tobacco six years ago. He has smoked since he was a small boy, using a pipe indoors and cigars outside. He was a total abstainer until twenty-four years of age; since then he has drunk beer and whiskey in moderation. He likes to have his food highly spiced. He is regular in his habits, was twenty-five years in the Police Department, and looks young for his age.

His present illness was first noted in 1894 when a snow-white patch appeared on the inside of his left cheek opposite the first molar tooth. This has grown

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steadily forward until it is now an oval patch 6 cm. long and 3 cm. wide. This covers practically the entire inner surface of the left cheek. This patch is snow-white in color, is raised 0.5 cm. above the level of the adjacent mucous membrane and is crossed by numerous deep fissures extending well into the substance of the cheek. These fissures bleed freely upon examination or while chewing his food. The mass is composed of a large number of thick, pearly-white, glistening, hypertrophied papillae closely overlying each other like an exaggerated piece of white velvet. It was not painful unless torn by some mechanical means. Its appearance when first seen was well shown by the accompanying sketch made at the time.

All forms of treatment appear to have been tried by the many physicians whom he has consulted during the seventeen years that this mass has been in existence. It was thoroughly burned with chromic acid by a prominent dermatologist; this caused much pain, but the growth continued. His former family physician burned it with nitric acid and gave him a red mouth wash to use. This had no effect, so a number of pieces were cut off with scissors and the base cauterized. At the end of a year of this treatment the condition was much worse than it was at the beginning. Thermo-cautery was used by another physician; this caused much pain, gave no improvement and the patient never returned for observation. A large number of mouth washes and various medications have been used—the formulas of these he does not know.

I first advised to discontinue the use of tobacco and alcohol entirely, have his teeth carefully cleansed and begin for the first time the habit of brushing them regularly each day. An alkaline mouth wash was advised for local cleanliness. Local application was made with pure carbolic acid over the patch, which after a moment or two was neutralized with pure alcohol. After a month of observation the growth appeared to be somewhat thinner in the centre and I had hopes that the prophylaxis and treatment which he had followed carefully would permanently relieve him.

Upon my return home from my summer vacation early in September, I found that for the preceding month, the patient had suffered much pain inside of the face, sometimes of great severity, and the area of growth was practically the same as when it was first seen.

It then occurred to me that inasmuch as leucoplakia is so frequently associated with syphilis, and though undoubtedly a different disease, closely resembles syphilis in some important particulars, it might be due to some organism similar in character to the spirochæte pallida or to some form of protozoa. If a large dose of arsenic administered intravenously would destroy the spirochæte, as it unquestionably does, possibly a similar treatment would have the same effect in this disease.

In order to be sure of the diagnosis and to exclude syphilis, the patient was referred to a reliable laboratory and the Wassermann test was made. Two tests were made by two different laboratories. In both instances the test was negative. Syphilis, therefore, could be excluded.

On the 14th of September, a full dose of salvarsan was administered in the median basilic vein of the left arm. Some difficulty was experienced in entering the vein with the needle for, because of the anæmic condition of the patient, the veins almost collapsed. He had a slight chill immediately after the injection; stimulation was given him and he was put to bed. Late in the afternoon he insisted upon returning home with his wife. The usual diarrhœa with some nausea, which frequently follows injections of 606, lasted for an hour or two, but by midnight his discomfort was at an end. He slept well that night for the first night in a month, and when seen four days later, stated that he had been entirely free from pain in his face ever since the injection was administered.

On the 23rd of September further increase in size of the growth had stopped and the edges had begun to separate noticeably from the underlying mucous membrane. The growth now appeared as if it could be lifted off from the surface of the cheek. This separation progressively continued, and on the 5th of October, he appeared before my clinic at the Post Graduate Medical College. No physician of the score or more who were present had ever seen a case of leucoplakia. This illustrates the rarity of the disease. By the end of October the growth had steadily separated from the periphery toward the centre, healing as the recession advanced, and early in November, when the patient was last seen, the leucoplakial growth had entirely disappeared and the mucous membrane lining the left cheek appeared to be in quite as healthy a condition as that of the right. He still suffered from anemia, for which tonics and iron were being administered, but so far as the

disease of his cheek was concerned, he was cured. He still remains cured. There has been no recurrence.

So far as I can determine this is the first time in which 606 was administered for the cure of leucoplakia, and the results secured could certainly not be surpassed.

A year elapsed before I had an opportunity to see another case, but on May 21, 1912, a former patient reappeared.



FIG. 10.—Leucoplakia at angle of mouth. Drawing from life. (Case X.)

CASE X (Fig. 10).—*Leucoplakia of right angle of mouth.* J. A. S., an American,

twenty-nine years of age. His family history was negative. He has had no serious illness. He stated that he had a chancre eight years ago, but no secondary symptoms ever developed, and his family physician believes that the sore noted was probably herpetic or a chancroid. No evidence of syphilis could be detected; there was no adenopathy.

When first seen in 1911, he came for an operation for a tumor of the left spermatic cord. This was removed by operation and proved to be tubercular in character. He came to my office after a year's absence in order that I might observe the ultimate result of the operation. The scar could be with difficulty determined, and there was no secondary involvement of the neighboring parts.

The patient called my attention to the fact that on the right side of the mouth

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there was a growth which had started during the previous year and which appeared to be extending. Examination showed this to be leucoplakial in character, of the typical fan-like arrangement of four or five striae, 1 mm. in width, extending posteriorly from the angle of the mouth upon the right side. The central strips were 2 cm. in length. The lateral ones were not so long. No pain had been experienced, but it was an annoyance to him in speaking and he felt continually obliged to rub the growth with the tip of his tongue.

A Wassermann test was made but proved negative. With the experience of the former patient fresh in mind, no attempt was made at any local treatment, save the penciling over the mucous membrane once or twice a day with a solution of permanganate of potash and a mouth wash of three parts of alcohol, one part of glycerin and six parts of water. The usual full dose of salvarsan was administered. The growth progressively decreased in size and at the end of a month the mucous membrane of the buccal cavity was normal. No recurrence has taken place.

CONCLUSIONS

Leucoplakia buccalis then may be regarded as a chronic, slowly progressive disease over the buccal mucous membrane.

The etiology of the disease is unknown. Local irritants in the mouth are unquestionably factors in its production, but it is probable that it is a disease of parasitic origin. Just what the parasite is remains to be determined, but that it is similar in character to the known parasite which causes syphilis and to the unknown parasite which often leads to the production of epitheliomata in the same region, is probable. Whether this parasite resembles the spirochaete, whether it is a protozoal form similar to a plasmodium of malaria, of Texas fever, of sleeping sickness or of other diseases, is not known. At any rate, it seems probable that it may be destroyed by the same means now at our disposal which will destroy the spirochaete. The writer has used salvarsan in two cases of malaria in which the plasmodium was found before the injection. Both patients have never had a subsequent chill, all their malarial symptoms have disappeared, and health has been restored. Subsequent examinations of the blood failed to show plasmodia. In one instance of non-operable small round-celled sarcoma of the upper jaw, subsequent to an operation where the entire superior maxilla was removed and the diagnosis determined beyond all question in one of the best hospitals in the city, this remedy was also administered with excellent results. Pain was eliminated, and for at least a year no further progress of the disease took place. It seems probable that arsenic administered in this form may be safely and widely used in all forms of disease of parasitic origin, non-bacterial in character. The capsule surrounding most of the bacteria appears to prevent the destructive action of arsenic and thus prevents beneficial results from being secured by the injection.

It, of course, would be unwise to predict that all cases of leucoplakia can be as readily cured by this means as the two which have been recorded, but at any rate, it is safe to state that a new weapon has been found which will in some cases at least act efficiently as a cure for a disease notoriously resistant to all former methods of medication or of treatment.

ABSCESS OF THE TONGUE

By ABRAHAM O. WILENSKY, M.D.

AND

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IT is a remarkable fact that acute infection of the tongue, in spite of the situation of the latter in an environment full of innumerable sources of infection, is rather rare. According to Combiér and Murad,¹ the frequency of such infections of the tongue is, indeed, in marked contrast to that of infection of the tonsils, the floor of the mouth and the naso-pharynx. The tongue escapes these dangers partly because of the special firmness of its mucosa, because of the absence of any submucous areolar tissue, because of the compactness of its parenchyma, as well as because of the nature of its musculature. Nevertheless, acute infections of the tongue do exist and are known. It is sufficient to refer to the descriptions of M. A. Bruce in the *Traité du Duplay et Reclus*,² to that of Morastin in the *Traité du Dentu et Delbet*³ and to that of Lebormant in *Precis de pathologie externe*. The subject has given rise to only a small literature of which, perhaps, the most important communications of the older group are one by Caulier and one by Thibaud⁴ and of which the most important communications of the more recent group are one by Saenz⁵ and one by Auperier.⁶ Bennet,⁷ in collating the literature from 1816 to 1909, was able to record only one hundred and forty-five instances of acute infection of the tongue. Butlin⁸ also emphasizes the rarity of acute disease of the tongue.

CASE REPORT

S. A., age sixty. Three or four days previously, the patient had caught cold, and had a running nose, fullness in the head and sore throat. Otherwise he disclosed no abnormalities. Except for some headache there were no marked constitutional symptoms. He was given the usual symptomatic treatment with some relief. On the third day following the first examination, the patient began to complain of some pain in the posterior part of his tongue; aggravated on motion of the organ. Accompanying this was some difficulty in swallowing and talking. These symptoms became rapidly aggravated and within twenty-four hours the tongue became swollen so that protrusion from the mouth was almost impossible and then only with extreme pain, lancinating in character, referred to the left ear, indicating an involvement of the chorda tympani nerve. At about the same time the patient complained of pain in the left loin which radiated down to the groin.

The past history of the patient had certain important features which made the present status somewhat complicated. A number of years ago the patient had acquired lues. Since then (eight years ago) he developed an epididymo-orchitis which cleared up under antiluetic treatment. A Wassermann test done at this time showed four plus. Shortly thereafter the patient began to complain of pain along the right ureteral region associated with dysuria. An X-ray examination

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at this time revealed a ureteral calculus lying in the ureter at its junction with the bladder. The subsequent history of this calculus is not definitely known. Presumably the pain subsided and nothing more was done. With the onset of the present tongue condition, ureteral pain recurred, but this time it was located on the opposite side to that in which the pain had originally been present.

Physical examination showed the tongue markedly swollen, more so on the left side than on the right, and especially toward its root. The surface had a grayish-white coating, which covered it uniformly. Protrusion of the tongue was attended with great pain and was practically impossible. The swelling was indurated and no area of fluctuation was made out at this time. The pharynx was very congested and the pillars of the fauces as well as the soft palate looked oedematous. There was no cervical or submaxillary glandular enlargement. The speech was thick. Otherwise nothing abnormal. Temperature 99.8. Pulse 84.

In view of the history and physical examination a diagnosis of abscess of the tongue was immediately made, with the one reservation, however, that the condition might be a gumma of the tongue. The usual local applications—such as cracked ice to relieve the inflammation and a mouth wash of potassium chlorate to keep the oral cavity clean—were employed. In addition, in view of the luetic history, potassium iodide was given in fifteen grain doses three times daily. The patient was closely watched for possible complications.

Two days later, the patient suddenly developed a chill, the temperature rose to 105.4, the pulse to 130, and he was moderately prostrated. The general physical examination at this time showed no change from the status previously described. Locally, however, there was a definite area of fluctuation to be made out in the centre of the swollen tongue. Anaesthesia by nitrous oxide and oxygen. The tongue was dragged out of the mouth as far as possible and after suitable protection of the pharynx to prevent any aspiration of pus, the abscess was first aspirated and then incised. The incision was made on the outer side of the tongue. About two drams of pus were obtained. The cavity resulting easily admitted an average sized thumb and was lined with granulation tissue. It was packed with iodoform gauze. The aspirated pus showed numerous Gram-positive cocci and bacilli. Culture yielded non-haemolytic streptococci, staphylococci, and diphtheroid organisms.

The subsequent recovery of the patient was slow. Following the removal of the first packing a moderate hemorrhage supervened. This was easily controlled by packing, but on several subsequent occasions the removal of the packing was followed by further hemorrhage. The hemorrhage was finally controlled permanently by removing the packing and suturing the edges of the wound. No untoward effect followed the suture and the wound healed kindly.

To ascertain the cause of the bleeding a section of tissue had been removed from the base of the cavity. Microscopically this showed abundant granulation tissue with numerous dilated blood spaces. No evidence of lues could be demonstrated in the sections, in spite of the fact, that at the time the section was taken, a blood examination showed that the Wassermann reaction was still four plus positive. Antiluetic treatment was instituted. There was no disturbance in the function of the tongue after the wound was healed.

SUMMARY

This was a case of a luetic person in whom after exposure to cold a nasopharyngitis developed. This was complicated by an acute glossitis which went on to suppuration, the abscess being localized to the left and posterior part of the tongue. After appropriate incision and drainage, the wound eventually healed with no untoward result.

Bennet,⁷ in reporting one hundred and forty-five cases found that the incidence of acute glossitis was not confined to adult life, but was equally prevalent at all ages. His youngest patient was nine months old; and his oldest, eighty years.

Butlin⁸ states, however, that the disease is most prone to occur in adults, and more commonly in men than in women. The disease is more often seen during the winter than in summer. In one hundred and fifteen of Bennet's cases the previous health was good. The most common predisposing factors were exposure to cold and wet, as well as to great heat followed by sudden chilling. As a rule, sore throat, tonsillitis, and such diseases as typhoid, erysipelas, variola, and thrush, have all been recorded. Thus, Weiss⁹ case followed the desquamation of scarlet fever. Washburn¹⁰ and Green¹¹ report a case following sore throat, and Sebrazes, Bonnes and Parsat,¹² scarlatinal sore throat. Erosions within the mouth, ulceration of the cheek, infections of the salivary glands, especially the parotid, pimples of the tongue, infected wounds caused by jagged teeth (occurring sometimes during an epileptiform convulsion), fractures of the lower jaw with fistulae leading into the mouth, burns and scalds of the tongue, local irritation such as occurs from excessive sucking of a pipe, and, as Loeb¹³ reports, the chewing of sticks of pine wood which may have scratched the tongue; all of these form an array of exciting factors recorded from time to time. Recently Raynor¹⁴ reported a case of parenchymatous glossitis following a submucous resection. Incidental factors may be actinomycosis, gout, diabetes, alcoholism and syphilis.

The method of spread is problematical. Thus in the cases following tonsillitis and salivary gland involvement, Combier and Murad¹ believe that the infection travels along the lymphatics which traverse the involved areas, although the exact paths are unknown. They quote Craigin to the effect that the lymphoid tissue disposed at the level of the lingual tonsil may perhaps be the point of dissemination of the infection. The cases due to direct trauma are obviously and more readily understood.

The types of tongue involvement which one sees are either superficial or deep. The superficial, according to Broca, are the usual types of stomatitis. The deep ones are, as a rule, a parenchymatous glossitis which go on to supuration. In several instances the process was a curious form of edema without pus formation. This type corresponds more closely to the one Butlin⁸ calls streptococcal glossitis in which the danger of extension into the neck, lungs, glottis and pericardium exists. On the other hand, the staphylococcus glossitis is characterized most frequently by an acute localized swelling which increases without any marked extension. The swelling is, at first, hard, finally fluctuates, and may burst into the mouth. Mixed infections, especially with streptococci, according to these authors, are most apt to produce multilocular abscesses with extension into the neck.

The pathology, according to Thibaud,⁴ is that of an acute violent inflammation. The vessels are engorged; the entire organ is distended with blood, followed by infiltration, with fibrin and serum into the intermuscular connec-

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tive tissue and into the planes of connective tissue separating the muscular fasciculi. There is very little change in the muscular fibres except that due to the pressure of the surrounding parts. Recovery takes place by resolution or suppuration. The suppurative process, unless subjected to early drainage, may extend to the pharynx or larynx. Gangrene may supervene due to the intense swelling, leaving only the stump of the tongue.

The bacteriology is varied as has been mentioned above. Mixed infections are probably more common than have been reported as in our case in which staphylococci, streptococci and diphtheroids and anaërobic bacteria were found. The process may involve the entire tongue or only a portion of it. Thus, of Bennet's series, the entire organ was affected at once in eighty-five, with no suppuration in sixty-six, and abscess in twenty-nine. Of thirty-six cases of hemiglossitis, in twenty it was confined to the left side, eight of which had abscess and twelve not. Of sixteen cases who had a right-sided hemiglossitis four went on to suppuration. From this it is quite evident that the left-sided involvement is most common. Corroborative literature to that effect is to be found in the cases reported by Thomas,¹⁵ Duckworth¹⁶ and Copeland¹⁷ and others.

In a third form of glossitis—as opposed to the superficial and deep forms referred to previously—the infection occurs first on one and then on the other side; nine such cases are on record.

The onset is, as a rule, acute; occasionally very slow, as in one of the cases of Comber and Murad, where for several months the patient complained of difficulty in swallowing owing to swelling of the tongue. The prodromal symptoms are characterized by general malaise, the usual chilliness of a cold, or the toxæmia that accompanies a sore throat. In a general way, the antecedent infection stamps the character of the onset. The fever varies from 99.8°F. to 104°F. Occasionally there is no fever. Our cases had 99.2°F., even though there was marked involvement of the tongue.

The attack, on the other hand, may be initiated by a sudden chill, high temperature, marked general discomfort, flushed cheeks, difficulty on swallowing and salivation. The accompanying pain may be referred to the jaws and occasionally to the ears, the latter because of involvement of the chorda tympani nerve. Associated with such symptoms, the swelling of the tongue increases rapidly until the entire oral cavity is filled. Protrusion of the tongue is agonizing, as well as any movement of the organ. Speech is interfered with as is the breathing at times. The surface may be covered with a dark brownish membrane, but at times the fur is dark gray. On palpation, the swelling is uniformly hard, or, in the presence of suppuration, focally fluctuant.

The diagnosis is usually obvious. Conditions, however, which bring about secondary swelling of the tongue may give rise to controversy from time to time. Thus, salivary calculi, acute ranula, herpes of the mouth, lips, tongue, and pharynx have been stressed by Mackenzie as giving rise to confusion in the diagnosis.

The differential diagnosis in the first of these is made by finding and expelling the calculus, following which there is prompt subsidence of the tongue swelling. In ranula, the swelling is mostly confined to the floor of the mouth. In connection with herpetiform eruptions, the obviousness of the latter forms an easy point of distinction. In the opinion of Bennet all of these conditions bring about an acute true glossitis which is a complicating factor of the primary condition.

In discussing the types of glossitis, mention has been made of the grave possibilities which may accompany streptococcal glossitis. In addition to the general septicæmic character of the complication, local dangerous phenomena, which render the prognosis rather doubtful, should always be borne in mind. Impending suffocation due to the extreme swelling, rupture of the abscess with the opening of a vein and resulting hemorrhage, spread of the infection into the submental connective tissue with a consequent Ludwig's angina, extension to the peritonsillar or post-pharyngeal region, pulmonary or mediastinal structures, are ominous possibilities.

In Bennet's series of one hundred and forty-five cases, the mortality was three per cent. This can possibly still be lowered by prompt surgical intervention.

The treatment is of course simple. Antiseptic mouth washes are indicated until a focus of liquefaction is discernible. Then prompt incision and drainage is necessary. Incision on the lateral aspect of the tongue, as was practised in the case reported by us, seems preferable. Owing to the muscular structure, this permits a more rapid agglutination of the surfaces after the packing is removed; and if any complication, such as hemorrhage, arise, it can more easily be controlled by suture.

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INTERCOSTAL THORACOPUNCTURE FOR THE REMOVAL OF PENETRATING PROJECTILES IN THE LUNG*

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Aspirated Foreign Bodies.—All foreign bodies that have reached the lung by the natural passages can be removed by bronchoscopy through the mouth, with ultimate recovery in about 98 per cent. of the cases.

Penetrating projectiles lodged in the middle or either lower lobe can also be removed by bronchoscopy through the mouth, if the projectile is not too large in its transverse diameter to permit its lengthwise withdrawal through the main bronchus. Foreign bodies that have penetrated the *mediastinum* can be removed by the bronchoscope or cesophagoscope, but the advisability of doing so is open to question. In one such case I deemed such removal inadvisable because the location of the foreign body below the heart would involve grave risk of rupture of the pericardium, owing to the angle of approach through the mouth. It was removed by Dr. Thomas W. Shallow, approaching through the ribs by thoracotomy with a perfect result. Penetrating projectiles lodged in the upper lobes, unless in a bronchus, are not readily removable by peroral bronchoscopy.

Thoracopuncture for Penetrating Projectiles.—Penetrating projectiles in any portion of either lung can, I think, be removed by intercostal thoracopuncture without rib-resection, and in certain cases without pneumothorax, hæmothorax, lung-suppurative or other complication; but the advisability of the procedure in a given case will doubtless depend upon the size and location of the intruder and upon the presence or absence of suppuration requiring external drainage. A large series of cases will be necessary to make clear the indications and contraindications of thoracopuncture; but as to its feasibility there can be no question.

By thoracopuncture is meant the intercostal penetration of the thorax by a special forceps (thoracopenetrator) inserted through the skin, pleura and pulmonary tissue, the instrument fitting its own track so tightly as to avoid open pneumothorax.

The following report of a case has no bearing on the question of advisability of removal of penetrating, non-suppurative projectiles imbedded in the parenchyma of the lung, except insofar as the simplicity, ease and harmlessness (in certain cases) of the method used may outweigh the considerations as

* Case presentation, by invitation, at the meeting of the Philadelphia Academy of Surgery, April 2, 1923.

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to the possible harmlessness of leaving the foreign body alone. The report is made simply to illustrate the fact that thoracopuncture can be, in a suitable case, a relatively minor procedure.

Case Report.—No. Fbdy. 1131. Ex-private U. S. Army, age twenty-seven years, wounded in action in France on August 28, 1918, a number of fragments of shrapnel penetrating the chest, from which there was free bleeding; no hæmoptysis. Evacuated to Base Hospital where a number of fragments of shell were removed. Transferred to Base at Paris, then to U. S.; all wounds healed

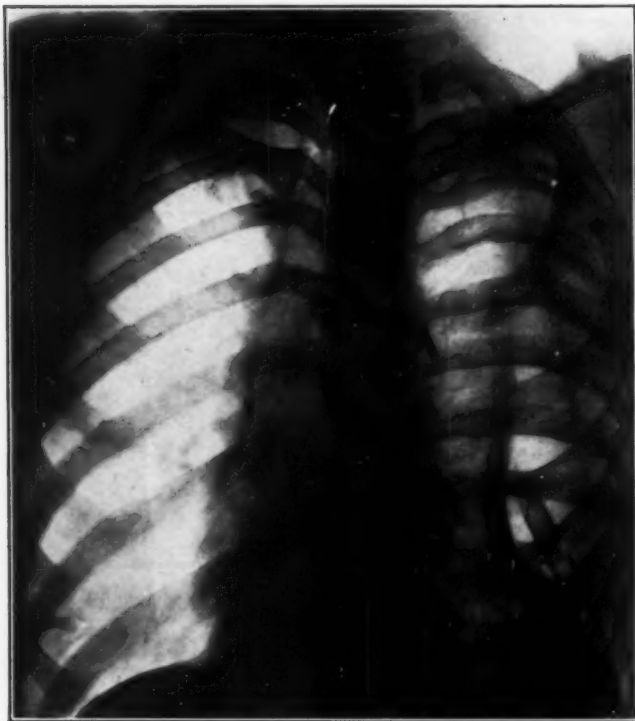


FIG. 1.—Röntgenogram showing shell fragment in left lung. (Film by Dr. Pillmore.)

March 3, 1919. Three years after healing a small pustule appeared in the scar. Ray study showed a fragment of metallic foreign body in upper lobe of left lung. Thoracotomy was done in a civil hospital but fragment could not be located. Admitted to League Island Naval Hospital with wound cavity discharging freely. Doctor Pillmore located the foreign body in the parenchyma of the left upper lobe (Fig. 1). Dr. Willis F. Manges found that there was no fistula leading from the fragment of shell to the wound cavity. In consultations with the Commanding Officer, Dr. Raymond Spears and Dr. J. Chalmers DaCosta it was decided that the fragment should be removed, for which the patient was referred to the Bronchoscopic Clinic. Lung-mapping by bronchoscopic bismuth subnitrate insufflation by the author's method† showed (Fig. 2) that the fragment was inaccessible by peroral bronchoscopy because of its location too far "around the corner," from the main bronchus, in the upper left lobe; whereas it would be readily accessible through the peripheral lung-tissue at a depth of about 4 cm.

The lung-mapping gave us the location of the large vessels which bear more or less constant relation to the tracheobronchial tree.

In collaboration with Dr. Willis F. Manges the thoracopunctator (Fig. 3)

† Jackson, Chevalier. The Bronchial Tree, Its study by Insufflation of Opaque Substances in the Living. *Amer. Journ. Rönt.*, October, 1918, p. 454.

INTERCOSTAL THORACOPUNCTURE

was devised. The parallel sides were designed to prevent leakage of air or blood past the instrument at least before the completion of the seizure and withdrawal of the foreign body. The point was designed to push aside rather than penetrate large vessels. As suggested by Dr. Thomas Shallow, if the pleura should prove too thick for penetration a puncture with a very slender tenotome would give the penetrator a start. The possible dangers considered were: 1, open pneumothorax; 2, hemorrhage with its associated risks of shock, hæmomediastinum, hæmothorax, infected hæmothorax, intrabronchial leakage and hæmodrownage, especially from the pulmonary artery, which Dr. J. Parsons Schaffer determined to

be within one centimetre of the shell fragment; 3, opening into the external suppurating cavity which did not previously communicate with the foreign body; 4, laceration of the pericardium which lay close posteriorly. All of these dangers were considered as almost negligible in view of a special technic planned to avoid or minimize the seriousness of all of them. Open pneumothorax was deemed an impossible result with the form of blunt penetrating forceps (thoracopentorator) de-

signed (Fig. 3) because the parallel sides of its shaft would occlude its own opening during the work, and the blunt conical wedge-shaped point would push aside and stretch the tissue the elasticity of which would close the wound of penetration after the withdrawal of the forceps and foreign body, which latter was to be withdrawn lengthwise, not crosswise. Because of the location of the foreign body close to the pericardium, the pulmonary artery and the root of the lung it was thought the procedure would call for the utmost care and precision in the penetration, seizure and removal of the foreign body so as to limit the wound of penetration to the track made by the forceps, which track was planned to avoid the internal mammary artery. The utmost care would be necessary to avoid penetration or laceration beyond the foreign body as the pulmonary artery was only 1 cm. deeper than the foreign body in the prolongation of the designed direction of approach.

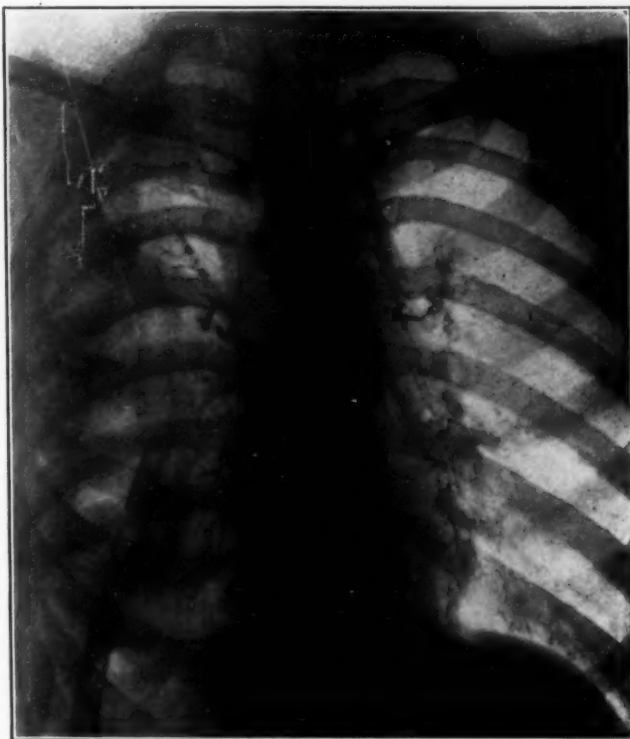


FIG. 2.—Lung-mapping with bronchoscopically insufflated bismuth subcarbonate, showing the relation of the projectile to the tracheo-bronchial tree. (Film by Dr. Willis F. Manges.)

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Precautions against Hemorrhage. From past experience the author has reached the conclusions that the best method of combating haemodrownage in severe traumatic pulmonary hemorrhage involving a bronchus is by "casing off" the bleeding lung with a large bronchoscope which at the same time "pipes" air down into the sound lung. Any blood that might leak past the "casing" bronchoscope is automatically removed through the aspirating canal; clots are wiped out with bronchoscopic sponges. Oxygen is supplied through the insufflation of the

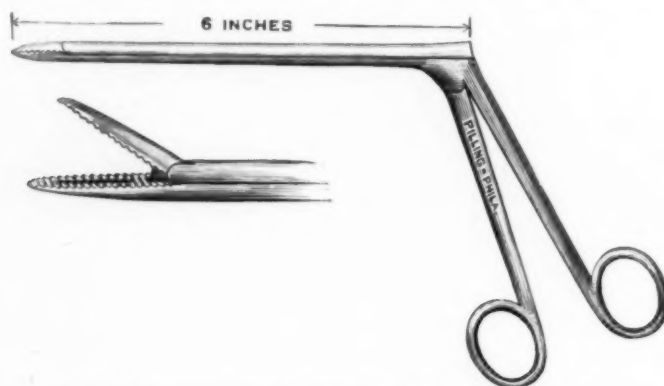


FIG. 3.—Thoracopunctator with parallel sides, as suggested by Dr. Manges to prevent leakage of air past it into the pleural cavity. Prevention of collapse greatly facilitates reaching and grasping the projectile under fluoroscopic guidance. The point is designed to push aside rather than penetrate large vessels or bronchi.

bronchoscope, if the patient is breathing; if not, through the independent tube. It is necessary that the bronchoscope fit snugly in the bronchus so as not to leave room for the leakage of much blood between the bronchoscope and the bronchial wall. In an adult the 9 mm. aspirating bronchoscope is the proper size. For casing off a bleeding lung the bronchoscope must not have the side-holes ordinarily placed in the wall for collateral respiration, because too much blood would leak through the holes. An œsophagoscope of proper size will serve the purpose. The 9 mm. would be the right size for an adult; and the "full lumen" model would be best, though the standard model would answer in an emergency. Avoidance of anæsthesia leaves all of the natural agencies of life-preservation unimpaired, therefore we decided against general anæsthesia, which moreover seemed unnecessary; but the method of casing off the operated lung and piping the sound lung is equally adapted to any thoracic operation under general anæsthesia.



FIG. 4.—Fragment of shrapnel removed through the chest wall by thoracopuncture.

Thoracopuncture.—Dr. Gabriel Tucker applied a little cocaine solution to the interior of the larynx. Dr. Louis H. Clerf quickly and skillfully introduced a 9 mm. bronchoscope (without side openings) into the right bronchus. Local anæsthesia along the track of the planned thoracopuncture was obtained by injection of the skin and the region of the intercostal nerves with novocain solution and a few drops of a 4 per cent. cocaine solution in the pleura. This was done so skillfully by Doctor Shallow that the patient never felt any severe pain and remained motionless throughout the procedure. Through a tiny puncture in the skin in the third interspace, one centimetre to the left of the vertical dotted location, we inserted the thoracopunctator using strong friction of the left hand to hold back the instrument and prevent its plunging. Doctor Manges with his

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double-plane fluoroscope gave me such accurate guidance that I was able to go directly to the shell-fragment, then open the jaws of the penetrator, seize the lower extremity of the fragment, rotate it so that its long diameter corresponded to that of the track of thoracopuncture and withdraw it without a single false grasp or false movement, thus causing no unnecessary trauma. A dressing was placed over the puncture.

Progress.—There was no expectoration, pain, hæmoptysis, hæmothorax, pneumothorax, or any other complication. The temperature was 100° F. the following day but came to normal the next morning and did not rise again. The patient was out of bed on the third day and going about the ward. This man was presented before the Philadelphia Academy of Surgery at its meeting of April 2, 1923, see page 537. A tiny scar at the site of puncture is the only trace of the operation. (Fig. 5). Ray examination by Doctor Manges shows no trace of the track of thoracopuncture.



FIG. 5.—Photograph of patient showing site of puncture. The scar was so tiny as not to show on a photograph; therefore a dart is used to indicate it.

CONCLUSIONS

1. In lung mapping by the author's method of bronchoscopic insufflation of bismuth subnitrate we have a harmless and efficient aid in the study and localization of penetrating foreign bodies and their secondary pathology.

2. In "casing off" the operative lung and "piping" the sound lung with a close fitting bronchoscope introduced through the mouth we have a safeguard in thoracic operative procedures, inasmuch as the absolute control over the sound lung enables the bronchoscopic assistant to prevent blood entering the sound lung and to maintain ventilation indefinitely whether the patient's breathing movements are suspended or not.‡

3. Thoracopuncture, carefully done, with necessary precautions, in suitable cases, seems such a minor procedure compared to extensive rib-resection that

‡ Gaub, O. C., and Jackson, C.: *Bronchoscopic Aid in Thoracotomy*. The Laryngoscope, February, 1910. See also *Bronchoscopic Oxygen Insufflation in Bronchoscopy and Oesophagoscopy*, by Chevalier Jackson, 1923. (text-book, W. B. Saunders Co.), page 71. Also in *Peroral Endoscopy and Laryngeal Surgery*, Chevalier Jackson. Text-book, p. 73 *et seq.*

it promises to modify the adverse opinion held by some surgeons as to the immediate presupplicative removal of small penetrating shell fragments, bullets and other penetrating projectiles lodged in the lung.

4. I feel sure that any small penetrating projectile not located near the root of the lung can be removed by thoracopuncture under local anæsthesia and leave the patient in better condition than if the projectile had gone clear through and emerged without touching a bone or large vessel. I feel sure that any clothing cap would be brought away with the projectile, but there was no fabric in the case herewith reported.

5. Intercostal removal, of course, has the fixed limitation of the maximum available size of the intercostal space. Larger projectiles would require rib-resection. Even in such cases, the thoracopunctator has the great advantage of penetrating the lungs without admitting air to the pleural cavity. Reaching and grasping the projectile under the fluoroscopic guidance are greatly facilitated by the uncollapsed state of the lung. After the intruder is grasped and brought to the ribs, resection may be done, while the projectile is held in the thoracopunctator. If the intruder is known beforehand to be too large for intercostal removal, the rib-section may be done first, care being taken not to make a leak through the parietal pleura. The thoracopunctator will then go in with an airtight fit.

6. Thoracopuncture can easily be a very dangerous and rapidly fatal procedure unless the utmost caution is observed in its planning and performance, and in preparedness for possible emergencies. Clawing around in the lung is unnecessary and dangerous. The thoracopunctator can be, I think, inserted, closed, in a safe track, until contact is made with the foreign body; then the jaws can be opened, intruder seized without a single false move and withdrawn through the track of entrance. This track is planned beforehand so that the approach will be through parenchymal lung tissue. Thoracopuncture should not be attempted except by, or with the coöperation of, the thoracic surgeon. The coöperation of an expert röntgenologist with the Manges double plane fluoroscope is essential for safety as well as success both in the planning and the execution of the procedure. It seems advisable to limit its use to penetrating foreign bodies in the periphery of the lung, avoiding the location of large vessels and the root structures.

7. Thoracopuncture is not advised for the removal of foreign bodies that have reached the lung through the natural passages, 99 per cent. of which can be removed through the mouth.

RESECTION OF STOMACH FOR CHRONIC GASTRIC AND DUODENAL ULCER*

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GASTRO-ENTEROSTOMY has been a well-established procedure in the surgical treatment of gastric and duodenal ulcers for the past thirty years. The first gastro-enterostomy for ulcer of the stomach was performed by Doyen in 1893.

For more than two decades following its introduction as a side-tracking, indirectly curative procedure for ulcer of the stomach, gastro-enterostomy, with or without pyloric exclusion, was considered as the method of choice. Plastic operative procedures on the pylorus (Heinecke-Mikulicz, Finney, etc.) have acquired some popularity. However, it is safe to say that up to recent years, gastro-enterostomy was considered the ideal operative procedure irrespective of what part of the stomach or duodenum was involved.

Enthusiasm for this simple procedure, however, is not as uniform as it used to be ten years ago. Many surgeons still claim that permanent cures of gastric and duodenal ulcers follow simple gastro-enterostomy in practically all cases. In recent years this procedure has fallen somewhat into disfavor. Whereas some clinics, even as recently as 1921, have published statistics with over 90 per cent. cures, other clinics have had much less favorable results, some of them reporting cures following gastro-enterostomy in not more than about 70 per cent.

That gastro-enterostomy does not give ideal permanent results is evident from the fact that many physicians hesitate to turn over their patients suffering from non-obstructing gastric or duodenal ulcers to the surgeon for a gastro-enterostomy. They claim that many of the patients thus treated are only slightly improved and that in some cases the condition is much worse than before the operation. The physician naturally reflects the voice of his patients. Evidently many patients suffering from gastric or duodenal ulcers are not cured following a simple gastro-enterostomy.

I do not want to enter here into a discussion of the different reasons why gastro-enterostomy may fail to effect a cure. The literature is full of different suggestions (place and size of the stoma, choice of suture material, improper medical after-treatment, etc.). The most dreaded complication following gastro-enterostomy is a subsequent gastrojejunal ulcer. Statistics as to the frequency of its occurrence differ widely. However, 3 to 5 per cent. seems to be a rather conservative estimate. It is a well-known fact that surgical treatment of gastrojejunal ulcers with adhesions to or perforations into the colon is a most difficult problem. Furthermore some patients have

* Read before the New York Surgical Society, April 11, 1923.

suffered from repeated recurrence of this condition, requiring three and more operations. In a paper on this subject,¹ published two years ago, I reported a case operated upon three times for this condition (two gastrojejunal ulcers and one jejunal ulcer). This patient, who has been perfectly well for the past two years, had to undergo four operations within a period of six years to obtain a more or less permanent cure. The pains caused by gastrojejunal ulcers are very severe, much worse than those caused by gastric or duodenal ulcers. These patients are worse off than they were before the gastro-

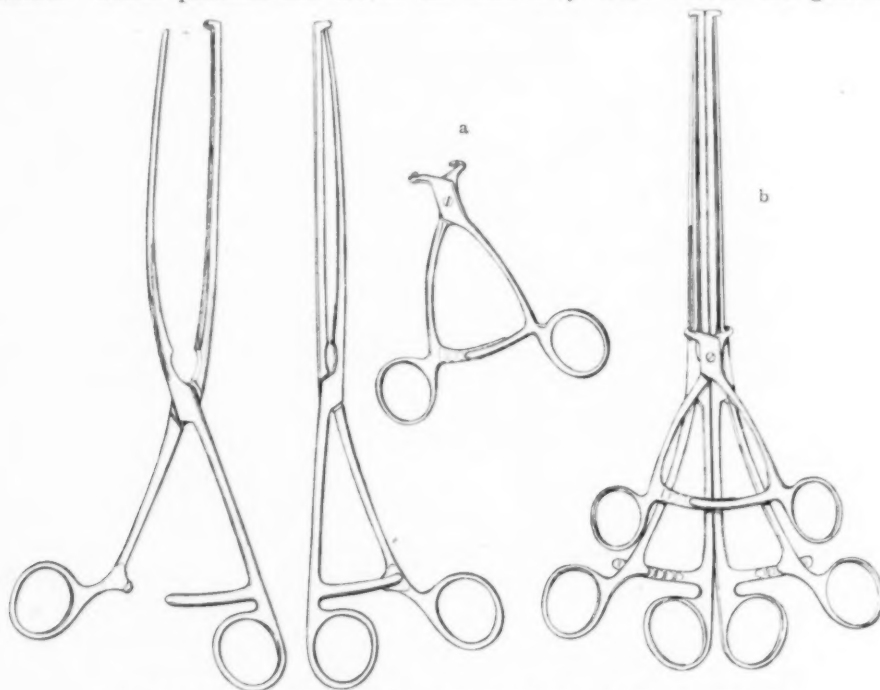


FIG. 1.—Maier Clamp. (a) Parts comprising clamp. (b) Clamp closed.

enterostomy. Besides their suffering, they face the possibility of perforation or hemorrhage.

The fact that simple gastro-enterostomy will fail to cure penetrating ulcers of the lesser curvature of the stomach has been recognized for some years. Gastro-enterostomy was gradually replaced by excision, either with knife or cautery (Balfour), resection of the lesser curvature (Schmieden), sleeve resection or partial gastrectomy. In very large ulcers, occupying practically the whole posterior wall of the stomach, jejunostomy may be preferable to subtotal gastrectomy.

There is one form of penetrating ulcer which ought to be treated with local excision, namely, the ulcer situated close to the cardia. However, it must be stated that in ulcers so situated even local excision is not entirely safe.

Resection of pyloric and duodenal ulcers, except those easily amenable to excision, was not attempted until lately. Haberer² showed that radical removal of practically every ulcer, even those adherent to pancreas or liver,

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is not only feasible, but that the mortality connected with these rather extensive operations can be very small.

Haberer's purpose in radical removal of pyloric and duodenal ulcers, which includes a resection of the antral portion of the stomach, is two-fold: First, to remove the ulcer and prevent later complications (perforation, hemorrhage, malignant degeneration), and secondly, to remove the antrum and the acid factory of the stomach and thus reduce the possibilities of the recurrence of an ulcer.

✓ What is meant by acid factory of the stomach? The acid-producing glands of the stomach are situated in the fundus. However, the antrum produces a hormone which stimulates the acid glands. In other words, the antrum contains the motor which starts the machinery of acid production. This area extends to about 8 or 10 cm. from the pylorus. By removing pylorus and antrum the possibility of recurrent ulcers is greatly reduced.

Pyloric exclusion seems to be a factor in the production of gastrojejunal ulcers. Haberer encountered eleven marginal ulcers among seventy-one cases of Eiselsberg exclusion. It is not probable that other simpler forms of exclusion will give so high a percentage of gastrojejunal ulcers. This question is now under investigation in a large series of patients in whom exclusions were performed according to Berg's method.

The resection of the stomach can be performed in two ways, either by the Billroth I or by the Billroth II method. I think it is wise not to practice one procedure to the exclusion of the other, but to select the method according to the individual case.

When the duodenum is freely movable, Billroth I represents the ideal procedure, because this method reestablishes normal conditions. Antrum,

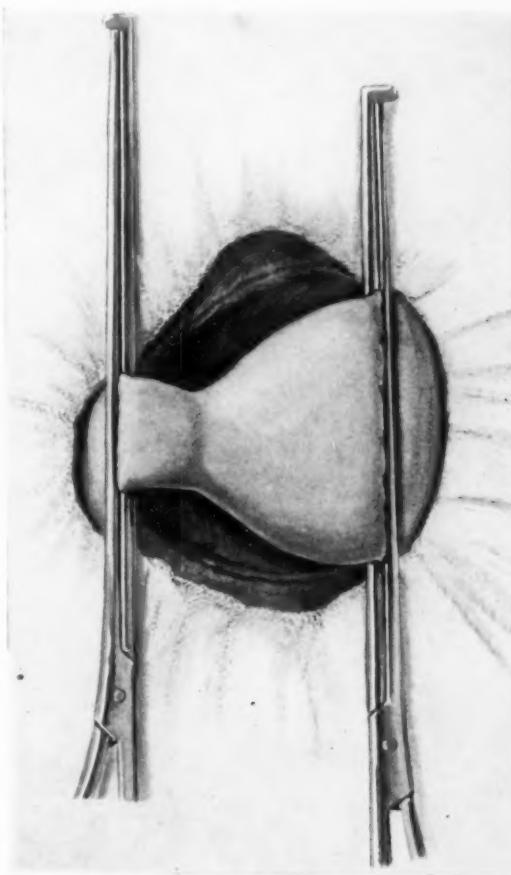


FIG. 2.—Clamps applied.

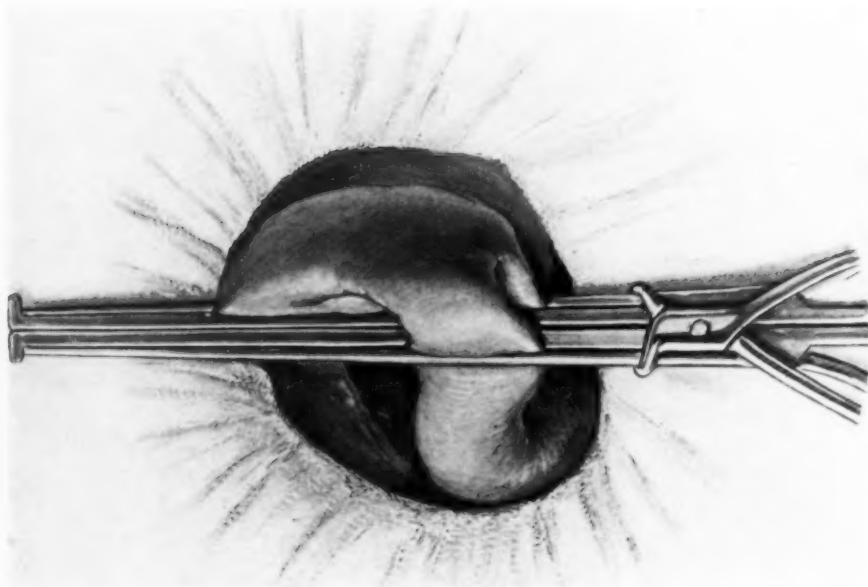


FIG. 3.—Blades approximated and locked by third clamp.

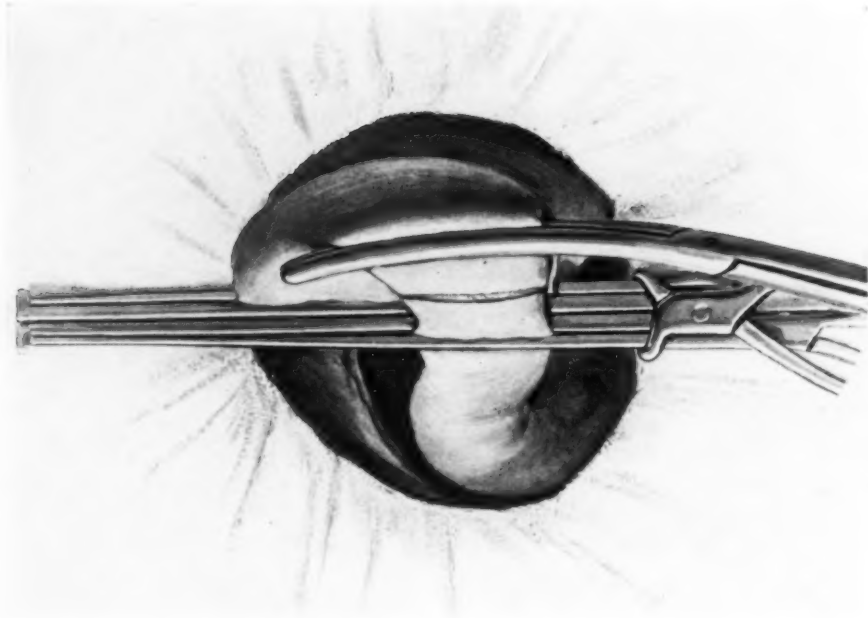


FIG. 4.—Serosa incised on anterior wall of the duodenum.

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pylorus and the ulcer (whether gastric or duodenal) are removed en bloc and both ends are reunited.

The vast majority of the duodenal ulcers are situated in the first part of the duodenum. Simple palpation of the ulcer without proper freeing of the duodenum often gives the false impression that these ulcers are situated in the second portion of the duodenum. However, after liberating periduodenal adhesions and splitting the peritoneum on the outer aspect of the duodenum, these ulcers are found to be in the first portion of the duodenum and as such can be resected en bloc with pylorus and antrum.

Adhesions of the ulcer to the pancreas are no contra-indication to radical procedure. Haberer has demonstrated that one may easily deal with these adhesions either by the cautery or by splitting the capsule of the pancreas. It was formerly assumed that such radical procedures would cause fat necrosis. The incorrectness of this view has been shown by the great number of cases so treated during the past few years. In fact, even after resection of the pancreas fat necrosis is not encountered when the defect in the capsule has been properly sutured.

If we want to perform a Billroth I resection, we have to free the stomach as well as the duodenum from the attachments, in order to be able to anastomose without tension. After proper freeing of stomach and duodenum, it is remarkable how easily the resected ends can be brought together, even though more than half of the stomach be removed. Haberer reports a case in which he did such extensive resection that he had to perform the Billroth I anastomosis under the left border of the ribs. In other words, he had to

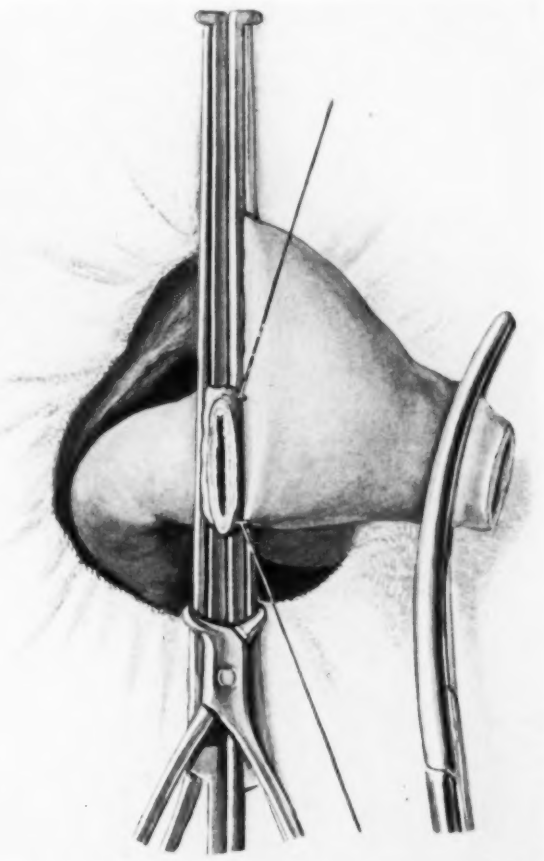


FIG. 5.—Duodenum cut through and silk guides applied.

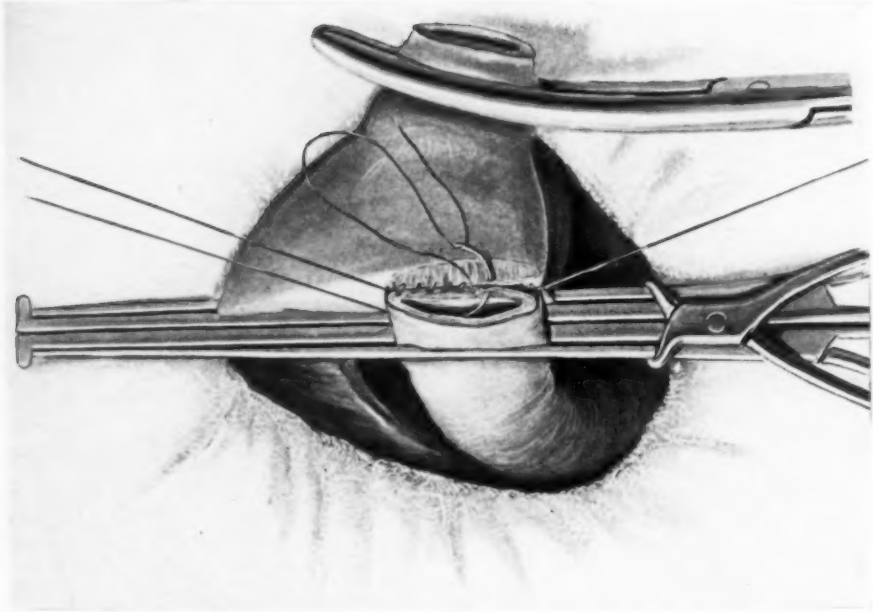


FIG. 7.—Posterior continuous sero-muscular suture applied.

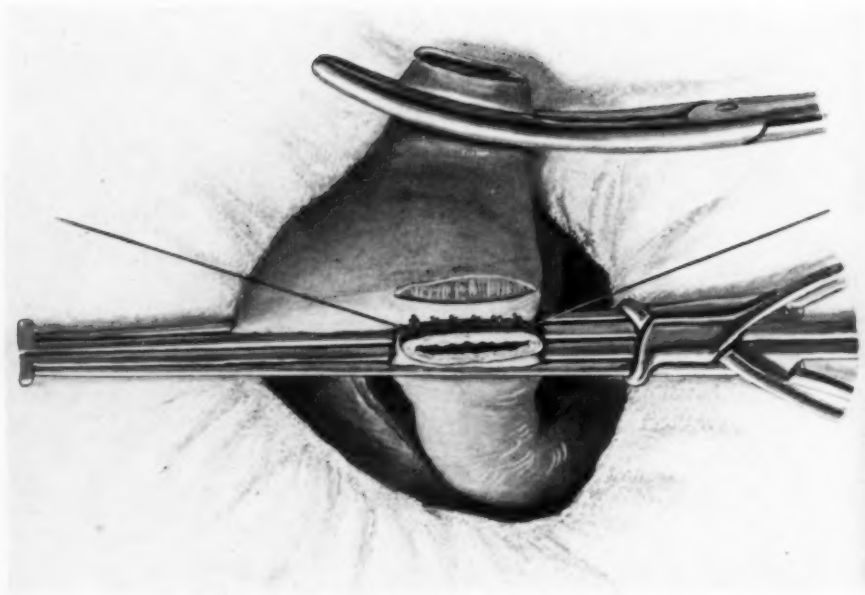


FIG. 6.—Interrupted silk sutures applied and serosa on the posterior wall of the stomach opposite to duodenal opening, incised.

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lift the duodenum over to the left hypochondrium. A perfect result was obtained.

When the ulcer is situated at the posterior wall of the duodenum, or so low that direct anastomosis between stomach and duodenum is not safe, we can either perform a Billroth II or use Haberer's³ method of gastroduodenostomy (a modified Kocher). Since the post-operative course following a Billroth II is smoother than that following a gastroduodenostomy, closure of both ends followed by a gastro-enterostomy is preferable.

Haberer's modification of the Billroth I technic is demonstrated in the accompanying pictures. The clamp shown in these pictures was constructed by Maier (Innsbruck). This clamp provides for excellent approximation of stomach and duodenum during the process of suture (Fig. 1). A similar clamp was constructed by Lane.

After proper liberation of the area to be resected the two clamps are applied (Fig. 2) and the clamp is then closed (Fig. 3). The duodenal serosa is cut on its anterior aspect (Fig. 4). The duodenum is then cut through and two silk guides fit the upper and lower angle of the duodenum (serosal stitch) to the posterior wall of the stomach (Fig. 5). A row of interrupted silk sutures is placed between these two guides and the serosa of the posterior wall of the stomach is cut. The length of this incision varies according to the size of the duodenum (Fig. 6). A running muscularis-serosal stitch is then placed in front of the interrupted silk sutures, both ends of this stitch being left long (Fig. 7). The gastric serosa is now incised for the whole circumference of the stomach. A clamp is applied on the gastric side and the stomach divided, thus removing that portion of stomach and duodenum to be resected (Fig. 8). The upper lumen of the stomach is closed with a

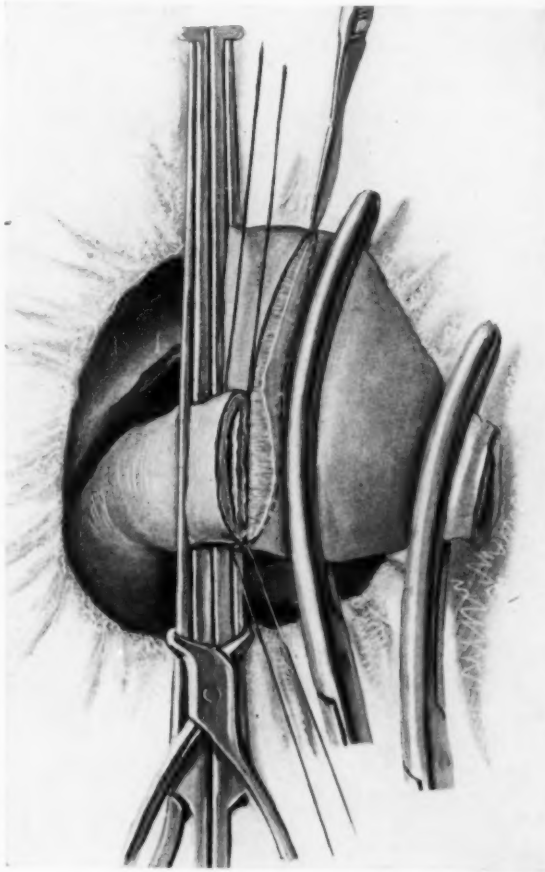


FIG. 8.—Showing line of resection of remaining portion of the stomach.

through-and-through catgut suture (Fig. 9). A running mucosal stitch closes the lumen of stomach and duodenum at the site of the anastomosis (Fig. 10). This suture line is covered anteriorly by a running muscularis-serosal stitch. Both clamps are then removed (Fig. 11). The suture line at the upper end of the stomach is then buried with a series of interrupted stitches (Fig. 12). A silk suture, taking in anterior and posterior walls of the stomach and upper border of the duodenum, is then placed at the upper end of the anastomosis

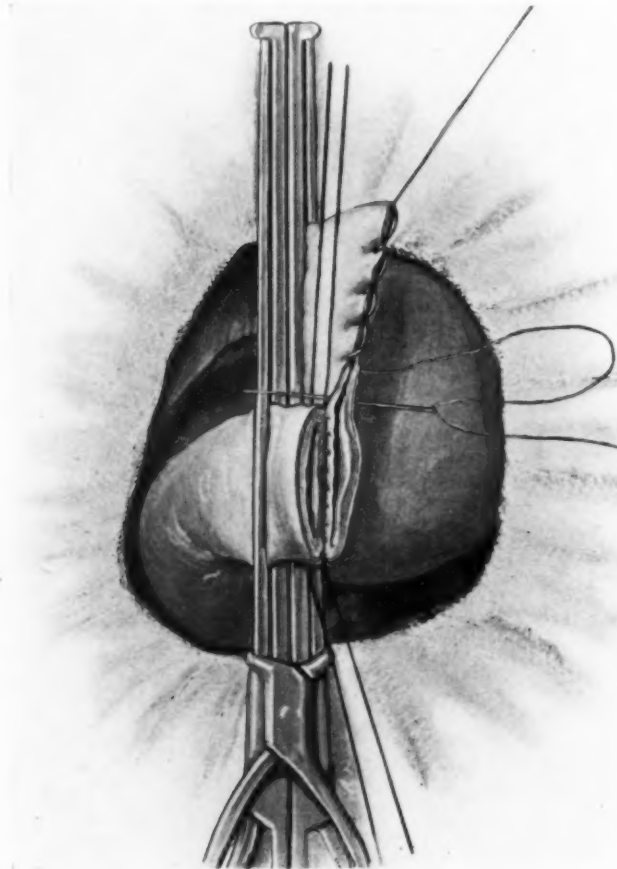


FIG. 9.—Closure of portion of stomach above point of anastomosis.

and tied with the silk guide which was left in place. It is very important to close in this angle (so-called "Jammerecke") in order to prevent leakage. The silk suture is then carried as a running suture along the anterior wall of the anastomosis and united with the silk guide at the lower angle of the anastomosis (Fig. 13).

It is very important that small needles and fine suture material are used for the anastomosis. The mucosa must be united in such a fashion that no pocketing occurs. The Connell stitch

should not be used for the direct anastomosis of stomach and duodenum as it causes protrusion of tissue into the lumen with secondary stenosis and retention. The technic described above might be simplified, if the stomach were resected immediately after the clamps are applied.

If the Billroth II method is used, it is advisable to cut through the stomach between two clamps immediately after ligation of the vessels. The proximal part of the stomach is covered with iodoform gauze. The distal part, also so protected, is brought over to the right, thus exposing the posterior wall

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of the stomach, the pancreas, and the median colic vessels. Adhesions, so frequent in this region, can then be dealt with under the guidance of the eye. The sharp dissection of the duodenal ulcer from the pancreas is made much easier by pulling stomach, pylorus and duodenum to the right. This procedure brings the periduodenal adhesions into excellent view.

After proper liberation below the level of the ulcer, the duodenum is resected and the lumen closed with a Connell stitch. For the second and third rows of sutures we usually have to use the capsule of the pancreas which provides excellent material for a proper closure of the duodenum. The proximal end of the stomach is then closed in three layers.

A number of different methods are at our disposal for the re-anastomosis of stomach and intestine. Posterior suture gastro-enterostomy gives very excellent results. If a subtotal gastrectomy has been performed, the Murphy button may be used. Before closing the gastric end one-half of a Murphy button is dropped into the remnant of the stomach, the other part of the button is inserted into the jejunum in typical fashion and a very small stab is then made into the posterior wall of the stomach. The gastric half of the button is pushed through this opening and stomach and jejunum are thus united.

A. A. Berg has used the long loop anterior antecolic gastro-enterostomy without entero-anastomosis in a large number of cases of partial or subtotal gastrectomies with excellent results. It seems unnecessary to add Braun's anastomosis, when performing an anterior gastro-enterostomy after resection of the stomach. While vicious circle may occur with open pylorus, this complication seems to be very rare after partial gastrectomy.

Other methods applicable for the gastro-enteric anastomosis are the Polya-Balfour method and Moynihan's modification of the Roux anastomosis.

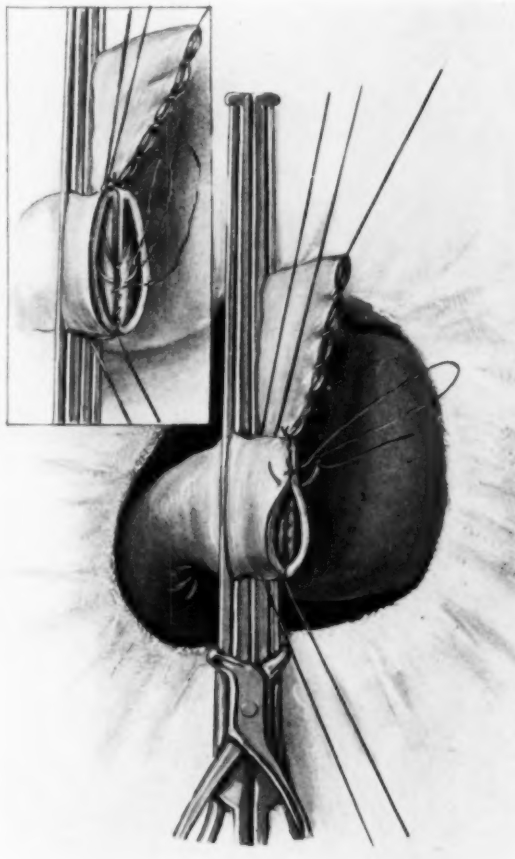


FIG. 10.—Suture of mucosa. Insert shows posterior suture line.

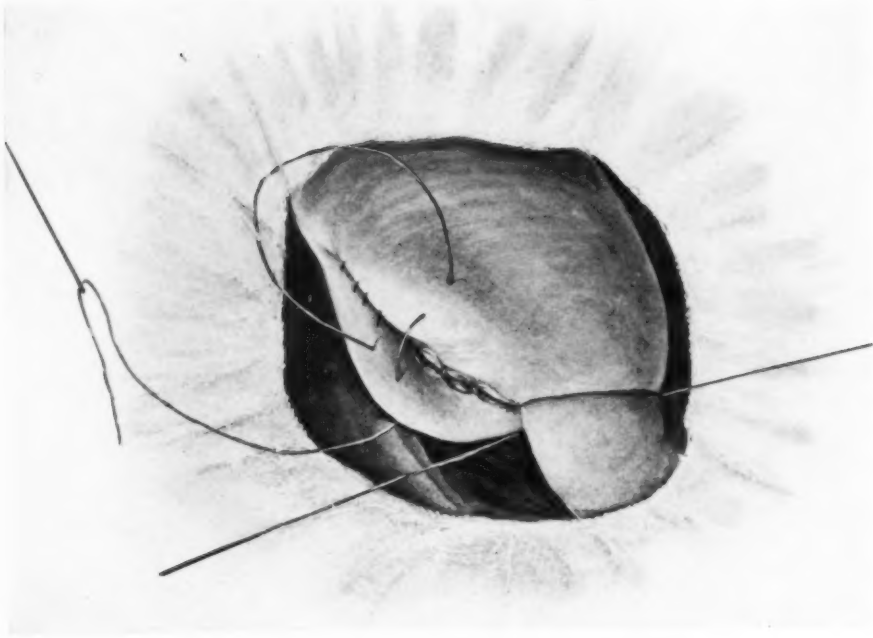


FIG. 12.—Interrupted silk sutures, infolding upper portion of the stomach and reconstructing lesser curvature.

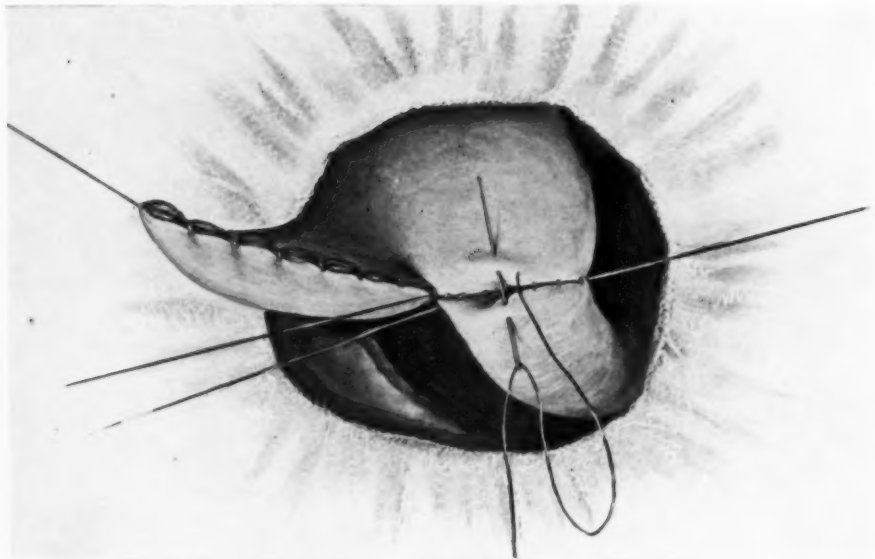


FIG. 11.—Anterior sero-muscularis suture.

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The question may be raised as to the necessity of such extensive procedures in view of the fact that the final step is a gastro-enterostomy. However, resection plus gastro-enterostomy seems to offer a much more favorable outlook for permanent cure than simple gastro-enterostomy or gastro-enterostomy with pyloric exclusion. With this more radical procedure we not only remove the ulcer, but minimize the possibility of gastrojejunal ulcers. It is a well-known fact that gastrojejunal ulcers are extremely rare following a resection of antrum and pylorus. Patients thus treated feel perfectly well and remain well. I have never seen a gastrojejunal ulcer following a partial

TABLE I.

Table Showing Acid Values Before and After Resection of the Stomach.

Case	Operation.	Before operation.		After operation, March, 1923.	
		Free HCl.	Total acidity.	Free HCl.	Total acidity.
1	1920	57	70	12	28
2	1920	20	60	0	16
3	1921	8	54	0	36
5	1922	not taken	not taken	0	17
6	1922	50	70	0	16
8	1922	39	64	9	25
9	1923	60	80	0	30
10	1923	32	64	5	12
11	1923	86	100	28	76
12	1923	56	84	0	24

gastrectomy. I have, however, observed a case of gastrojejunal ulcer following simple pylorotomy.¹

Following simple gastro-enterostomy acid values of the gastric contents are usually not changed materially. The regurgitation of the bile is supposed to reduce hyperacidity, but fails to do so in the vast majority of instances. Lorenz and Schur have recently published a paper, showing the marked diminution of acid values following resection of the stomach. I am studying this question at present by comparing the gastric contents of resections with those following simple gastro-enterostomy. This question now under investigation will be the subject of a subsequent communication.

I would like here to quote briefly some figures obtained with Ewald test-meals before and after the operation in my cases of resection for gastric and duodenal ulcers reported below. The table shows that following resection of the stomach free acid disappears entirely in the majority of cases and does not return even after long intervals. (Table I.)

My personal experience with resection in gastric and duodenal ulcers comprises twelve cases with one death (mortality 8 per cent.). Ten patients are perfectly well at present, the interval since the operations varying from two months to three years. One patient (Case IV: partial gastrectomy with button gastro-enterostomy) returned to us eight months after the operation suffering from a stenosis of the stoma, as sometimes seen following

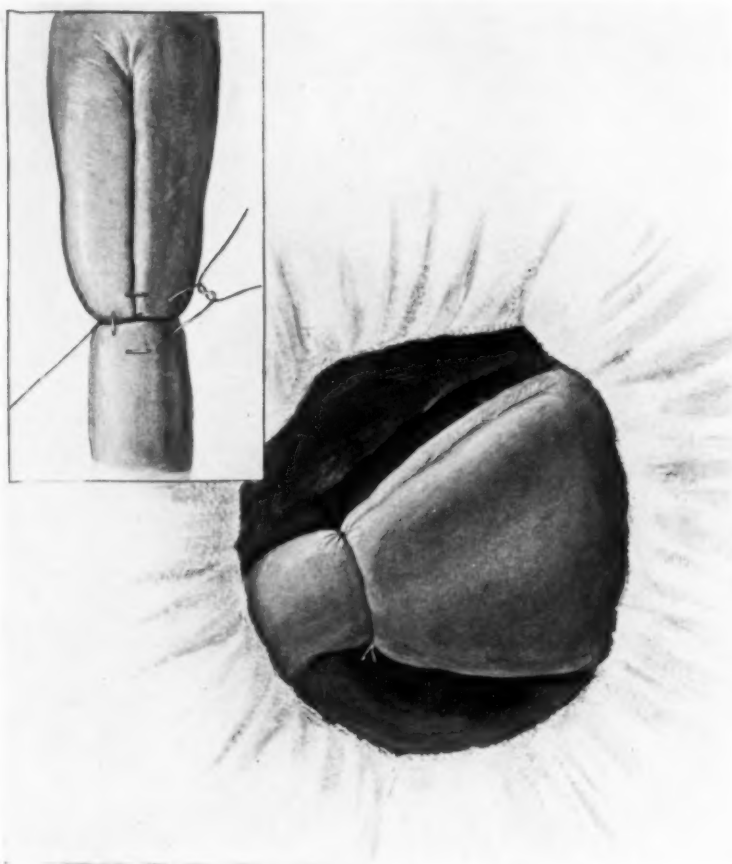


FIG. 13.—Continuous silk suture completing the anastomosis. Insert shows method of reinforcing upper angle of anastomosis.

the use of a Murphy button.⁵ He refused reoperation. Eight patients were suffering from penetrating ulcers of the lesser curvature, four from pyloric and duodenal ulcers. Billroth II was performed in ten cases, Billroth I in two cases. The operative recovery was remarkably smooth, much smoother than in many cases of gastro-enterostomy. The Murphy button was used in the first six cases. In one of these the button fell into the stomach and had to be removed by subsequent gastrotomy.

I am well aware of the fact that the number of my cases is very small. The question of the usefulness of a method can only be settled by a large

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series of cases. Such series have been published by Haberer and Friedemann. Haberer⁶ has performed Billroth I for gastric and duodenal ulcers in two hundred and fifty-six cases with 5 per cent. mortality and Friedemann⁴ reports one hundred and fifteen Billroth I with 2.6 per cent. mortality. These figures compare very favorably with mortality following gastro-enterostomy (Peck,⁸ 10 per cent.; Pool,⁸ 7 per cent.; Scudder,⁸ 6 per cent.).

The question of anaesthesia is very important. In debilitated patients an attempt should be made to get along without a general anaesthetic. With the proper coöperation of the patient thorough infiltration of the abdominal wall is often sufficient to allow the resection, though the first steps (ligation of the vessels and division of adhesions) are often very painful. Avoidance of a general anaesthetic reduces the possibility of post-operative pneumonia. However, some patients are severely shocked following a resection without a general anaesthetic. This method of anaesthesia (as used by Haberer and others) is erroneously called: local anaesthesia. It should be called: anaesthesia of the abdominal wall. With the exception of the abdominal wall the operative field is not anaesthetized. In fact, the major part of the operation is performed without any anaesthesia whatever.

Lumbar or splanchnic anaesthesia are too risky to make them commendable for gastric resections. Local infiltration of the operative field (lesser omentum, gastro-colic ligament, etc.) obscures the landmarks and makes resection much more difficult. If a general anaesthetic is used, gas and ether, given by an expert anaesthetist, is preferable. A general anaesthetic was given in the cases reported below, except in Case VII, which was performed following an anaesthesia of the abdominal wall, without causing much pain to the patient.

I have left untouched the question of pre-operative and post-operative management of the patient, but it does not differ much from that used in other abdominal operations.

It is too early to state definitely whether this radical procedure should be used extensively in the surgical treatment of pyloric and duodenal ulcers. A very large experience has to be gathered in different surgical centres, before this question can be definitely settled.

It is very probable that even following resection occasional recurrences may occur. In fact, single instances of recurrence following the Billroth I, as well as the Billroth II resection, have been reported.

This more radical attack of gastric and duodenal ulcers certainly offers a very favorable outlook. Gastric resection not only removes the ulcers radically, but in the vast majority of cases it seems to effect a permanent cure.

CASE REPORTS

CASE I.—D. W., twenty-three, male. Admitted to Mount Sinai Hospital, March 4, 1920. Discharged April 4, 1920. *Diagnosis:* Penetrating gastric ulcer lesser curvature of stomach. *Operation:* Partial gastrectomy (Billroth II); Button gastro-enterostomy.

History: Patient has had epigastric distress with typical hunger pain for the

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last five years. Marked intermission of symptoms. X-ray examination shows large penetrating ulcer of lesser curvature of the stomach.

Operation: Subtotal gastrectomy for penetrating ulcer adherent to the pancreas; button gastrojejunostomy. The vessels were ligated. Stomach freed posteriorly by cutting through base of ulcer, leaving it attached to pancreas. The stomach was then liberated beyond the pylorus and resected; both proximal and distal ends closed in three layers. Button gastrojejunostomy was performed. *Microscopic Examination:* Benign ulcer with inflammatory glands. Uneventful recovery. Reexamination March, 1923: Patient feels perfectly well.

CASE II.—H. S., fifty-five, male. Admitted to Mount Sinai Hospital, October 24, 1920. Discharged November 12, 1920. *Diagnosis:* Penetrating gastric ulcer lesser curvature of stomach. *Operation:* Subtotal gastrectomy; button gastrojejunostomy.

History: Epigastric distress for one month; no vomiting; frequent eructations. For last week pain has been very severe. X-ray examination shows a large penetrating ulcer at the reentrant angle.

Operation: Subtotal gastrectomy for penetrating ulcer lesser curvature; button gastrojejunostomy. *Findings:* Large indurated ulcer about two inches in diameter, not adherent to the pancreas. *Procedure:* Ligation of vessels and freeing of adhesions. Stomach divided proximally to the ulcer and about one inch beyond the pylorus. Closure of both ends in three layers. Button gastro-enterostomy. Specimen shows a large callous ulcer, size of 50-cent piece, with sharp edges; surrounding tissues were very much indurated. Uneventful recovery. March, 1923. Patient feels perfectly well.

CASE III.—M. C., twenty-eight, male. Admitted to Mount Sinai Hospital, June 20, 1921. Discharged July 16, 1921. *Diagnosis:* Penetrating ulcer, lesser curvature of stomach. *Operation:* Partial gastrectomy; posterior button gastro-enterostomy.

History: Patient has had attacks of severe epigastric pains for the last ten years; no vomiting. Eight years ago exploratory laparotomy was done at another hospital; no abnormality was found in the stomach; the appendix was removed. X-ray examination shows a slight delay in motility; no defect in the stomach or at the duodenal cap.

Operation: Partial gastrectomy; button gastro-enterostomy for penetrating ulcer. *Findings:* Large indurated ulcer on the lesser curvature not adherent posteriorly. Typical gastrectomy and button gastro-enterostomy was performed. *Microscopic Examination:* Simple ulcer. Uneventful recovery. Reexamination, March, 1923: Patient has gained twenty-three pounds since operation.

CASE IV.—J. F., thirty-eight, male. Admitted to Mount Sinai Hospital, October 3, 1921. Discharged October 19, 1921. *Diagnosis:* Penetrating ulcer lesser curvature of stomach. *Operation:* Partial gastrectomy; button gastro-enterostomy.

History: Radiating pains in upper abdomen one hour after meals for last two months; pain lasts about one hour; no vomiting; marked constipation. X-ray examination shows penetrating ulcer lesser curvature of the stomach.

Operation: Findings: Penetrating ulcer of the lesser curvature of the reentrant angle. Typical partial gastrectomy with button gastro-enterostomy performed. *Microscopic Examination:* Simple gastric ulcer. Uneventful recovery. Readmission June 21, 1922. Discharged June 24, 1922. *Diagnosis:* Stenosis of gastro-enterostomy stoma.

History: For the last two months patient complains of pain and frequent vomiting one hour after meals. X-ray examination of the gastro-intestinal tract shows the stoma about 1 to 1½ inches above the most dependent portion of the gastric stump. The barium passes through the stoma in a narrow stream, but

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the stomach does not empty completely as late as twenty-four hours. The residue, however, seems to be in the part distal to the stoma. The stoma is normal in appearance but very tender on manipulation. Advised laparotomy but the patient went home against advice. March, 1923: Patient cannot be located.

CASE V.—O. S., forty-nine, male. Admitted to Mount Sinai Hospital, December 19, 1921. Discharged January 9, 1922. *Diagnosis:* Penetrating ulcer, lesser curvature of stomach; epigastric hernia. *Operation:* Partial gastrectomy; button gastro-enterostomy; hernioplasty.

History: Patient has been troubled with epigastric distress for the last three years; no vomiting, but considerable belching. X-ray examination shows ulcer on the lesser curvature of the stomach with one-third residue after 24 hours.

Operation: Findings: Large indurated callous ulcer of the lesser curvature densely adherent to the pancreas. A partial gastrectomy and button gastro-enterostomy were performed in the typical fashion. *Microscopic Examination:* Callous ulcer. Uneventful recovery.

Readmission June 19, 1922, for removal of button. *Operation:* Gastrotomy; removal of button. Abdominal wall closed with through-and-through silk stitches under marked tension. Healing delayed by gangrene of skin. Patient discharged with ventral hernia July 18, 1922. Reexamination: March, 1923, patient well.

CASE VI.—D. B., thirty-four, female. Admitted to Mount Sinai Hospital, June 6, 1922. Discharged June 26, 1922. *Diagnosis:* Hour-glass stomach, due to ulcer. *Operation:* Partial gastrectomy; button gastro-enterostomy.

History: Epigastric pain for six weeks. X-ray examination shows evidence suggestive of an ulcer of the lesser curvature of the stomach at or near the reentrant angle. The contour showed a marked incisura a little above the transition from the vertical to the horizontal positions. This incisura was persistent. Gastric motility was delayed.

Operation: Partial gastrectomy for hour-glass stomach, probably due to ulcer. *Findings:* A marked hour-glass stomach was found; there was a constriction at about the reentrant angle; the lumen of the stomach at this place just admitted two fingers. There were some adhesions which stretched across the stomach; these adhesions were evidently secondary to an old ulcer at this site. After the division of the stomach the hour-glass formation persisted. A partial gastrectomy with button gastro-enterostomy was performed in the typical manner. Specimen did not show any ulcer of the mucosa. The ulcer causing the hour-glass formation has healed completely. Uneventful recovery. Reexamination: February, 1923, patient well.

CASE VII.—H. M., forty-two, male. Admitted to Mount Sinai Hospital, November 24, 1922. Died December 6, 1922. *Diagnosis:* Penetrating ulcer, lesser curvature. *Operation:* Partial gastrectomy; anterior gastro-enterostomy; entero-anastomosis.

History: For past four years attacks of burning pain in epigastrium, lasting three to four weeks. Has lost about twenty pounds. Pain is accompanied by vomiting. X-ray examination showed practically complete pyloric obstruction due to adhesions at the pylorus; no evidence of penetrating ulcer at the lesser curvature.

Operation: December 4. Partial gastrectomy; anterior gastro-enterostomy; entero-anastomosis. *Findings:* A large ulcer, about one and one-half inches in diameter, was found along the lesser curvature slightly adherent to posterior parietes. The pylorus was thickened and hypertrophied. Partial gastrectomy was done in typical fashion. The closure of the upper angle of the stomach was difficult as inflammatory tissue extended a good distance beyond the ulcer. Both gastric and duodenal stumps were closed in three layers. An anterior suture gastro-enterostomy was performed, followed by a Braun entero-anastomosis. The

resection was performed with local anaesthesia of the abdominal wall; a little gas was given for the closure of the abdominal wall. December 6. Patient has facies hippocratica. Pulse rapid and feeble; respirations rapid and shallow; temperature 102° ; marked general abdominal tenderness. *Diagnosis*: Peritonitis. Patient died on the same day. Post-mortem examination showed small leak at the upper angle of suture line of the stomach with secondary peritonitis. *Microscopic Examination*: Simple ulcer.

CASE VIII.—S. S., twenty-three, female. Admitted to Mount Sinai Hospital, October 27, 1922. Discharged November 21, 1922. *Diagnosis*: Pyloric stenosis due to healed ulcer. *Operation*: Resection of pylorus and antrum of stomach (Billroth I).

History: Patient has suffered severe attacks of nausea and general abdominal cramps for last year; no vomiting. X-ray examination shows a one-third residue after six hours.

Operation: Partial gastrectomy (Billroth I) for stenosis of pylorus. Median incision between the ensiform process and umbilicus. The pylorus feels markedly thickened, hardly admits tip of small finger. Resection of pylorus and antrum of stomach. Anastomosis made in Billroth I fashion using Haberer's technic as described above. Through-and-through chromic for peritoneum and fascia, silk for skin. Specimen shows markedly hypertrophic musculature at pylorus, opening just admitting lead pencil. Uneventful recovery. X-ray taken two months after operation shows perfect emptying time. March, 1923: Patient feels perfectly well.

CASE IX.—E. B., forty-five, male. Admitted to Mount Sinai Hospital, January 6, 1923. Discharged February 8, 1923. *Diagnosis*: Duodenal ulcer. *Operation*: Partial gastrectomy; posterior suture gastro-enterostomy; cauterization of ulcer.

History: Patient was admitted to the Medical Service suffering from severe pain in epigastric region. The pains were so severe that they suggested possibility of impending perforation. After the pain had subsided X-ray examination was performed, which showed an irregular duodenal bulb. He was then transferred to the Surgical Service.

Operation: Partial gastrectomy; posterior suture gastro-enterostomy and cauterization of ulcer for ulcer in the second portion of the duodenum. Findings: Crater ulcer was felt in the duodenum. Duodenum made somewhat movable by splitting peritoneum on its outer border. The stomach was divided midway between the stomach and cardia. The duodenum was freed in its first portion. It was now seen that the ulcer was in the second part. Finger introduced into the foramen of Winslow, felt the common duct in close proximity to the ulcer. Division above the ulcer. Cauterization of the ulcer *in situ*. Closure of the duodenum in three layers. Posterior suture gastro-enterostomy with chromic gut. Layer suture of abdomen. Drainage with piece of rubber dam. Patient made an uneventful recovery. Reexamination March, 1923. Patient well.

CASE X.—B. S., forty, male. Admitted to Mount Sinai Hospital, February 20, 1923. Discharged March 16, 1923. *Diagnosis*: Duodenal ulcer.

History: Patient has complained of severe epigastric pain for the last two years. The attacks are so severe that the patient insists on exploratory laparotomy in spite of negative X-ray findings.

Operation: Partial gastrectomy and posterior suture gastro-enterostomy for duodenal ulcer. *Findings*: Gall-bladder showed few adhesions. A small ulcer on the anterior wall of the duodenum just beyond the pylorus, size one-half finger-nail. Duodenum bound down by adhesions. After splitting of hepato-duodenal ligament the duodenum was liberated. Gastric vessels were ligated and stomach divided about midway between the cardia and pylorus. The duodenum was dis-

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sected away from the pancreas by sharp dissection and then divided just below the site of the ulcer. The duodenum was closed, using the pancreas capsule for the second and third layers. Closure of the proximal end of the stomach in three layers. Posterior retrocolic suture gastro-enterostomy. No drainage. Through-and-through chromic catgut for muscle and fascia. Interrupted silk for skin. Uneventful recovery. *Microscopic Examination*: Benign ulcer.

CASE XI.—S. P., fifty-two, male. Admitted to Beth Israel Hospital, February 13, 1923. Discharged March 22, 1923. *Diagnosis*: Pyloric ulcer with obstruction.

History: Vomiting for two months, after each meal. *X-ray*: Shows a large six-hour residue and a deformed cap.

Operation: February 28, 1923, four-inch pararectus incision, resection of stomach and posterior suture gastro-enterostomy for obstructing pyloric ulcer. *Findings*: Pylorus very narrow and contracted. A small scar is seen next to pylorus and somewhat proximal to it on the anterior surface of the stomach. The hepato-duodenal ligament contained a number of hard glands. Stomach considerably dilated.

Operative Technic: Pylorus, antrum and first part of duodenum freed from their vessel supply sufficiently to permit a hemi-gastrectomy. Stomach then clamped off centrally and cut through. Pylorus and duodenum were densely adherent to pancreas. Capsule of pancreas cut into, to free adhesions. Distal half of stomach cut away. Duodenum closed in three layers, using the pancreas capsule for second and third layer. Proximal end of stomach closed in three layers. Posterior suture gastro-enterostomy. Uneventful recovery. *Microscopic Examination*: Healed ulcer.

CASE XII.—J. M., fifty-two, male. Admitted to Beth Israel Hospital, February 26, 1923. Discharged March 24, 1923. *History*: Epigastric pain for two months. No vomiting. *X-ray*: Penetrating ulcer on lesser curvature of stomach.

Operation: March 3, 1923. Median incision between ensiform process and umbilicus. Penetrating ulcer three-fourths inch in diameter found at reentrant angle of stomach, not adherent to pancreas. Typical Billroth I according to Haberer's technic. Closure of abdominal wall in layers. No drainage. *Course*: Uneventful recovery. *Microscopic Examination*: Benign ulcer.

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RECURRENCE OF INGUINAL HERNIA AFTER OPERATIVE TREATMENT*

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THE operation for the radical cure of inguinal hernia with its very low and almost negligible mortality rate, the freedom from serious post-operative complications, and short hospital confinement, has been long considered one of the simplest of major operations, and, by many surgeons, as relatively unimportant. The extremely low percentage of recurrences shown by published statistics seemed to assure the patient of a reasonable certainty of permanent cure, and, until recently, probably no operation has been generally regarded as more satisfactory in this respect.

Within the last few years the careful study given the subject of inguinal hernia has led to more accurate methods of following up cases, with a view to determining the end results, which has resulted in considerable modification of the views formerly held as to the curability of the different varieties. It is now felt that the cure of oblique hernia and direct hernia are two very different propositions. While in the former permanent relief may be obtained in a large percentage of the cases by a high ligation of the sac, supplemented by almost any of the recognized methods of repairing the canal, in the direct variety the results from operation still leave much room for improvement. When it is further considered that the great majority of inguinal herniae, probably 90 per cent. of the primary ones, are of the oblique variety, it is readily seen that statistics of recurrence in any series of cases is apt to be misleading unless the two groups are considered separately.

Reports of recurrences also lose much of their value because, on account of the difficulty in getting patients to return for examination, conclusions are often partly based upon correspondence with the patient. Such reports cannot always be accepted as reliable, since it is a well-established fact that patients frequently have slight recurrences which may readily escape attention without a careful physical examination. Some instructive figures are given in this connection by Taylor in a study of the results of operations performed for inguinal hernia at Johns Hopkins Hospital from January 1, 1899, to January 1, 1918, which appeared in 1920. He found that, while among 356 cases of indirect hernia operations examined at the hospital there were 30 recurrences, or 8.4 per cent., on the other hand, there were only 16 recurrences, or 3.4 per cent., among 460 cases of the same type of hernia who responded by letter; and, while among 47 cases of direct hernia examined there were 14 recurrences, or 29.7 per cent., among the same number heard from, only 3, or 6.3 per cent., reported recurrences.

* Read before the New York Surgical Society, April 25, 1923.

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The difference of opinion as to the length of time that should elapse before a hernia can be considered cured has further confused the subject, and shows the need of a uniform standard of time for following cases if statistics of recurrence are to be of value for purposes of comparison.

Since many of our large hospitals have developed efficient follow-up systems that obviate the sources of error mentioned and require the examination of patients for at least two years after operation, the optimism that formerly prevailed as to the results from hernia operations has been somewhat dispelled, and it has become more and more apparent that the percentage of recurrences following the usual operations is very much higher than it was previously thought to be. This is especially true of the direct variety, in which the greatest number of relapses occur. The many new or modified operations that have been devised in recent years may be regarded as further evidence that surgeons are far from satisfied with their results. In some of these operations the method of dealing with the hernial sac is a feature, while in others special attention has been paid to the repair of the musculo-fascial layer of the inguinal canal by reinforcing the muscles with flaps from the external oblique aponeurosis, or by transplantation of the rectus muscle. They embody no new principles, however, all containing the main features of the original operation of Bassini, *i.e.*, the high ligation of the sac, closure of the transversalis fascia when possible, and reconstruction of the inguinal canal. It does not seem likely, therefore, that improvement in results will come from changes in the fundamental principles of the present hernia operation; rather must we look for a reduction of relapses by the elimination of errors which are shown by the conditions found at operation for recurrence to be frequent causes of failure.

For convenience, recurrences may be grouped under the following headings: 1st, those due to errors of judgment in the selection of cases for operation, or in the type of operation employed; 2nd, those due to a faulty execution of the plastic repair; and 3rd, those due to what may be termed "operative accidents."

In attempting to explain the failures to obtain cures, it must be recognized at the outset that there is a small group of cases that will probably recur, in spite of any operation that is done, the recurrence not being necessarily due to a faulty choice of operation or a poorly executed repair, but rather to the type of hernia, and to the anatomical conditions present. In general, these cases belong to a group comprising about 7 per cent. of all herniæ described nearly twenty-five years ago by Bloodgood, which are characterized by a weak or absent conjoined tendon. Herniæ associated with this defect, while more often seen in old men with relaxed abdominal walls, are also met with in young individuals who have poor or deficient muscular development in the inguinal region. If these patients while standing erect are asked to strain, there will often be revealed a bulging extending from above the anterior superior spine, parallel to Poupart's ligament, obliquely downward to the rectus muscle. On examination of the patient in the recumbent posi-

tion, a diastasis of the external oblique is at times recognized, and the examining finger will readily pass through a large external ring into the internal fossa, meeting practically no resistance until the posterior surface of the pubic bone or edge of the rectus muscle is reached. Both oblique and direct herniæ are encountered in individuals of this type, the latter more frequently. According to Bloodgood, 50 per cent. of direct herniæ are associated with this deficiency of the conjoined tendon, and recurrences following the ordinary operations in this variety ranged from 20 per cent. to 50 per cent.

Other questionable types of hernia, as far as cure goes, are the large oblique ones of long standing, containing bowel or omentum. In these the deep epigastric vessels have been gradually drawn downward, and the obliquity of the inguinal canal is lost, the internal and external rings being directly superimposed, so that, from an examination before operation, it is almost impossible to tell whether the hernia was originally direct or oblique. The bearers of these herniæ are frequently men past middle age, who have worn trusses so long that the tissues immediately surrounding the ring are weakened and stretched from pressure to such an extent as to be almost useless for the repair of the canal. So-called "sliding herniæ" are sometimes encountered in these patients, and then, in addition to the difficulty of repairing the canal, is added the problem of managing the protruding intestine. Under the most favorable conditions of closure there will remain a small portion of bowel uncovered by peritoneum, which presents at the internal ring, ready to escape and spread apart the repaired canal.

Many cases belonging to the groups mentioned above should never be submitted to operation, and, unless a certain degree of selection be exercised, recurrences will remain on the high side. A careful examination and sound surgical judgment, based on a wide experience, are required in order to choose from this group those patients upon whom operation may be undertaken with a reasonable assurance of success.

The failure to recognize that no one operation is suitable for all types of herniæ is undoubtedly responsible for many relapses. In oblique hernia removal of the sac to such an extent that there is no dimpling of the peritoneum, forms an important feature of practically all the recognized operations. This simple procedure alone, if properly done, is sufficient to produce a cure in certain of the herniæ of this type, where the muscles are well developed, and there is not an undue widening of the inguinal canal. There is still considerable difference of opinion as to the desirability of transplanting the cord in these oblique herniæ. Theoretically, leaving the cord untouched in its natural bed, as is done in the Coley-Bull, the Ferguson, and other operations of the same type, should give better results in this variety than transplantation, because the weak point, the opening for the cord, is transferred to a distance from the internal ring, which in turn is strengthened by a buttress of muscles. In the experience of the writer, however, this theoretical advantage has not been proved in practice, and there has been a slightly larger

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percentage of recurrence from this so-called anatomical operation in my hands than where the cord has been transplanted, the recurrences in most instances taking place at the lower angle of the canal, at the point of exit of the cord. As a result I have returned to the transplantation of the cord, employing the Bassini or the Andrews operation, except in the case of children or in the presence of an associated undescended testicle.

In the direct variety of hernia it is generally agreed that the best results follow transplantation of the cord. In this type, when the muscles are strong and bulky, and the sac is small, the Bassini operation will give good results. These conditions, however, are rather exceptional in direct hernia, and it is usually necessary to secure additional strength by suturing the inner leaf of the aponeurosis of the external oblique to Poupart's ligament, as is done in the Andrews and other similar operations. Even this procedure may be insufficient in some cases of direct hernia as well as indirect, of the types already discussed, where at operation a large sac and a wide inguinal canal is found, with practically nothing but a weakened layer of muscle and fascia to utilize in repair. These questionable cases, if operated upon at all, will frequently require further reinforcement for the posterior wall of the canal, which may be obtained by transplantation of the rectus muscle.

The importance of thoroughly separating the neck of the sac from the surrounding transversalis fascia, and performing a high ligation, has already been referred to. The neglect to properly carry out this detail of the operation is no doubt responsible for many of the relapses in oblique cases, the recurrence occurring at the internal ring, and, as a rule, following the course of the cord. Recurrence at this point may also follow an operation where too large an opening has been provided for the transplanted cord. This is not so liable to occur if care is taken to remove from the cord the excess of fat, and any lipomata, and to excise varicosities, so that the space necessary for its exit from between the muscles and ligament will be reduced to a minimum. As a further precaution it is advisable to draw the muscles snugly about the cord by one or more sutures placed lateral to the internal ring, as suggested by Coley. In small herniæ of the direct variety some operators do not seem to attach a great deal of importance to removal of the sac, and it is sometimes untouched, on the ground that it is so small there is really nothing to resect. Removal of these small sacs, or what often only amounts to taking up the slack in a slight bulging of the peritoneum, followed by closure of the transversalis fascia, is felt to be just as essential a step as it is in the larger and more completely developed protrusions, otherwise a potential wedge is left that tends to enlarge and separate the repaired structures, no matter how well the reconstruction may have been performed.

Another technical error that has seemed to me a most frequent cause of recurrence is the failure to recognize the presence of a hernia of the "saddle-bag" or "pantaloons" type, where the sac bulges on both sides of the deep epigastric vessels and to remove both portions of it. This type of hernia, which is probably rightly considered primarily direct, though, strange to say,

not mentioned in most works on surgery, is fairly common. Recently in an examination of the operative findings in 40 cases of direct hernia a well-marked double sac was found in 25 per cent. of them. Others have placed the incidence of this condition very much higher, Huguët stating that it is possible to demonstrate a small indirect sac in all direct herniæ. The double sac is probably less frequently overlooked where the direct part of it is the more prominent lesion, but may readily escape attention where there is a fairly large oblique sac, and only a small bulging in Hesselbach's triangle. Under these conditions the small direct sac may be missed, unless one makes a habit of palpating at operation the internal fossa through the opening of the oblique sac, or, when operating under local anæsthesia, having the patient demonstrate by coughing the presence or absence of a combined sac. The fact that many of the oblique herniæ do not recur through the internal ring, but in the form of direct, always suggests the possibility that a direct sac was overlooked at the original operation, or was in an incipient stage of development at that time. In these cases evidence of recurrence is present as a rule fairly early—usually within a few months. These direct-indirect herniæ should be treated by the same methods of repair as the direct. The double sac may be converted into one by pulling the direct portion upward and out, and pushing the deep epigastric vessels down, as suggested by Downes, Huguët and others; or these vessels may be first ligated and cut. I am not aware that one method has any advantage over the other, as far as ultimate results go. When operating under local anæsthesia, however, my impression is that ligation of these vessels is preferable, causing less discomfort to the patient than the pulling upon the peritoneum incident to converting the direct sac into an indirect one.

One of the essentials of any plastic operation, *i.e.*, that the parts entering into the repair of a defect be united without tension, is especially desirable in hernial repair, where the structures one attempts to unite are, at best, poorly adapted for such union. To meet these requirements it is important that the sutures be tied evenly, and with only enough tension to just approximate the structures entering into the repair, otherwise strangulation will occur, and the normal muscular and fascial tissues will undergo fibrosis. That the structures utilized in the repair of the inguinal canal are often too forcibly drawn together and held with heavy sutures under tension is evident from the condition sometimes found at operation in recurrent cases. The line of suturing will be found intact, but the edge of Poupart's ligament will be torn away with a recurrence through the rent, or the internal oblique and conjoined tendon will appear as a thin and weak layer of fibrous tissue through which the recurrence has taken place mesially. In cases where it is evident that approximation cannot be obtained without tension, I have found Lyle's suggestion for obtaining relaxation of the inguinal triangle by flexion and inward rotation of the thigh, combined with slight elevation of the trunk, to be of great assistance, not only for the immediate requirements of the operation, but as a routine part of the post-operative treatment.

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Recurrence, associated with marked atrophy and thinning of the muscles, will also occur as the result of destruction of the nerve supply of the muscles by cutting or inclusion in the sutures at the original operation. The late Doctor Bodine, in one of his early papers on local anaesthesia hernia, was among the first to emphasize the desirability of preserving the nerve supply of the inguinal region for the purpose of avoiding subsequent atrophy of the muscles utilized in the repair. Dowd and a few others have also called attention to this subject, but the importance of this small detail does not seem to be generally recognized or admitted.

Among the complications and accidents of operation, suppuration stands foremost as a causative factor of recurrence, and in operations where this complication occurs relapses may be expected in about one-third of the cases. Taylor, in his review of Johns Hopkins' cases, reports 8 infections among 816 herniæ of the oblique variety, with 2 recurrences, or 25 per cent., and among 94 direct cases, infection occurred 4 times—2, or 50 per cent., of which recurred. The recurrences following infection usually show a diffuse scar formation, and the muscles and tendinous structures of the canal are widely separated, the protrusion taking place at any point in the canal. Slight forms of infection also predispose to recurrence when they involve the deeper structures. These low-grade infections are sometimes only evidenced by a small collection of serum which slowly works to the surface under the scar, and in the discharge that escapes remnants of the deep sutures occasionally may be recognized. Though often apparently insignificant, infections such as these may result in premature separation of the deep stitches, with a consequent weakening of the reconstructed wall. To lessen the chances of sepsis, and provide the most favorable conditions for primary union, avoidance of rough handling of the tissues while operating, and securing of complete hæmostasis, are essential. Both traumatism and the subsequent oozing may be reduced to a minimum by substituting clean cut dissection for the old methods of defining the hernial sac by blunt dissection, or by separating the tissues with a swab.

There are recurrences occasionally encountered where at the second operation there is no evidence of any union between Poupart's ligament and the muscles of the abdominal wall, the parts either appearing as if no operation had been done, or there being the remnants of only a few bands of tissue extending between the previously united structures. This is usually explained as being the result of premature separation of the deep sutures, due to their being improperly tied, or too rapidly absorbed. Another possible explanation of such a condition, which has not received much attention, can be found in the retching and vomiting that occurs after general anaesthesia. The pressure exerted upon the lower part of the abdomen and the abdominal muscles by the patient recovering from the influence of a general anaesthetic is considerable, and places a severe strain on the recently repaired hernia, which may be sufficient to cause the sutures to cut through, if the tissues are

under tension to begin with. For this reason the avoidance of general anaesthesia in hernia operations has seemed to me highly desirable, and for the past fifteen years local anaesthesia has been used as a routine in these operations, with the feeling that, in addition to its other advantages, one possible cause of recurrence was eliminated.

Another somewhat similar accident to which some relapses have been attributed is the slipping of the ligature from the neck of the sac. Moschowitz mentions two cases where he felt that this had taken place, because at re-operation the hernial contents were not covered by any parietal peritoneum, being simply buried in a mass of loose adhesions. In none of the recurrences that have come under the writer's observation could this be shown to be the cause of relapse, but the accident has occurred within my knowledge after ligation and removal of a fairly large oblique sac, the operator being compelled to re-open the wound within a few hours on account of hemorrhage. An instance is cited by Seward Erdman where, in a bilateral operation done at one sitting the ligature slipped off the first side, the accident being recognized by the presence of blood in the peritoneal cavity when the second sac was opened. Erdman also calls attention to an observation that in operating for bilateral hernia, especially direct, it is possible in ligating the sac on one side to exert sufficient traction to be felt on the opposite side; in view of which, this accident must be looked upon as a possible though rather infrequent cause of some of the recurrences.

In individual cases probably other explanations of the failure to obtain a cure may be found, as operating in the presence of definite contra-indications, such as chronic cough or chronic urinary obstruction; permitting the patient to undertake heavy work too soon; and the wearing of a truss after operation.

SUMMARY

It is felt that the operative cure of inguinal hernia is not the simple procedure that many surgeons regard it, but is an operation requiring sound surgical judgment, as well as considerable technical skill.

Oblique and direct hernia should be looked upon as two distinct conditions, in both of which recurrence is probably more frequent than was formerly recognized—this being especially true of the direct form.

Improvement in operative results is not likely to come from the development of an operation based upon new principles, but in the elimination of what are considered to be frequent causes of failure to obtain a permanent cure. These are:

- (1) Subjecting to operation patients in whom, on account of the type of hernia, and the condition of the parts that must be utilized for repair, there is small chance of obtaining a permanent cure.
- (2) The use of an operation which, while adequate in some cases, fails to meet the indications in an individual case.

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- (3) The failure to thoroughly remove the sac or to recognize and remove a double sac.
- (4) Repair of the canal under tension.
- (5) Injury to the nerve supply of the inguinal region.
- (6) Infection.
- (7) Separation of the repaired structures from a failure of the sutures to hold, or from the strain of post-operative vomiting.

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TREATMENT OF WEBBED FINGERS CONGENITAL OR ACQUIRED*

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AND

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THE term webbed fingers is used in describing all cases where the fingers are all joined together. As a matter of fact, a distinct web such as found in a duck's foot seldom exists. As a rule, congenital webbed fingers are associated with deformity of the phalanges. The web varies in size and extent in different cases, and not infrequently in the same hand or foot, it may be only a suggestion of one or extend to the extreme tip of the finger or toe.

A number of operations to correct the deformity have been proposed. The operations in general use are those advocated by Didot and Agnew. In our experience, neither of these types nor their modifications are successful in cases where the web is narrow or in the acquired type, due to burns. The object of any operation is to cover the entire denuded area and to prevent recurrence of the web. The former is accomplished by use of the Ollier-Thiersch graft and the latter by the Agnew flap, if it is made especially long. The sloping found in a normal hand starting from a point midway between the heads of the metacarpal bones to a point opposite the middle of the first phalangeal bone is accomplished nicely by the Agnew flap. An Agnew flap is outlined and dissected free to its base.

The web is then divided in the mid-line well beyond where the normal web would be, then by pressure with your gloved finger the separation of the soft tissues should be continued until you have the separation deeper than in the normal hand. We advise this division to be made by blunt dissection so that the nerves and blood vessels to the fingers will not be divided. The Agnew flap is now sutured in place. (See Figs. 1 and 2.)

An impression of the area between the two fingers produced by the division of the web as shown in diagram number three is then made in modelling compound and after covering the raw surfaces with an Ollier-Thiersch graft, the modelling compound is reintroduced over the graft. This modelling compound has the advantage of keeping the fingers well separated and holds the grafts in accurate approximation with the raw surface, thus preventing serum from collecting under the grafts, as well as keeping the grafts at body temperature.

Our attention was directed to this method by the uniformly good results we obtained by skin grafting within the mouth by the use of modelling compound dressings. We have found it advisable not to do more than one web

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FIG. 1.—Agnew method.



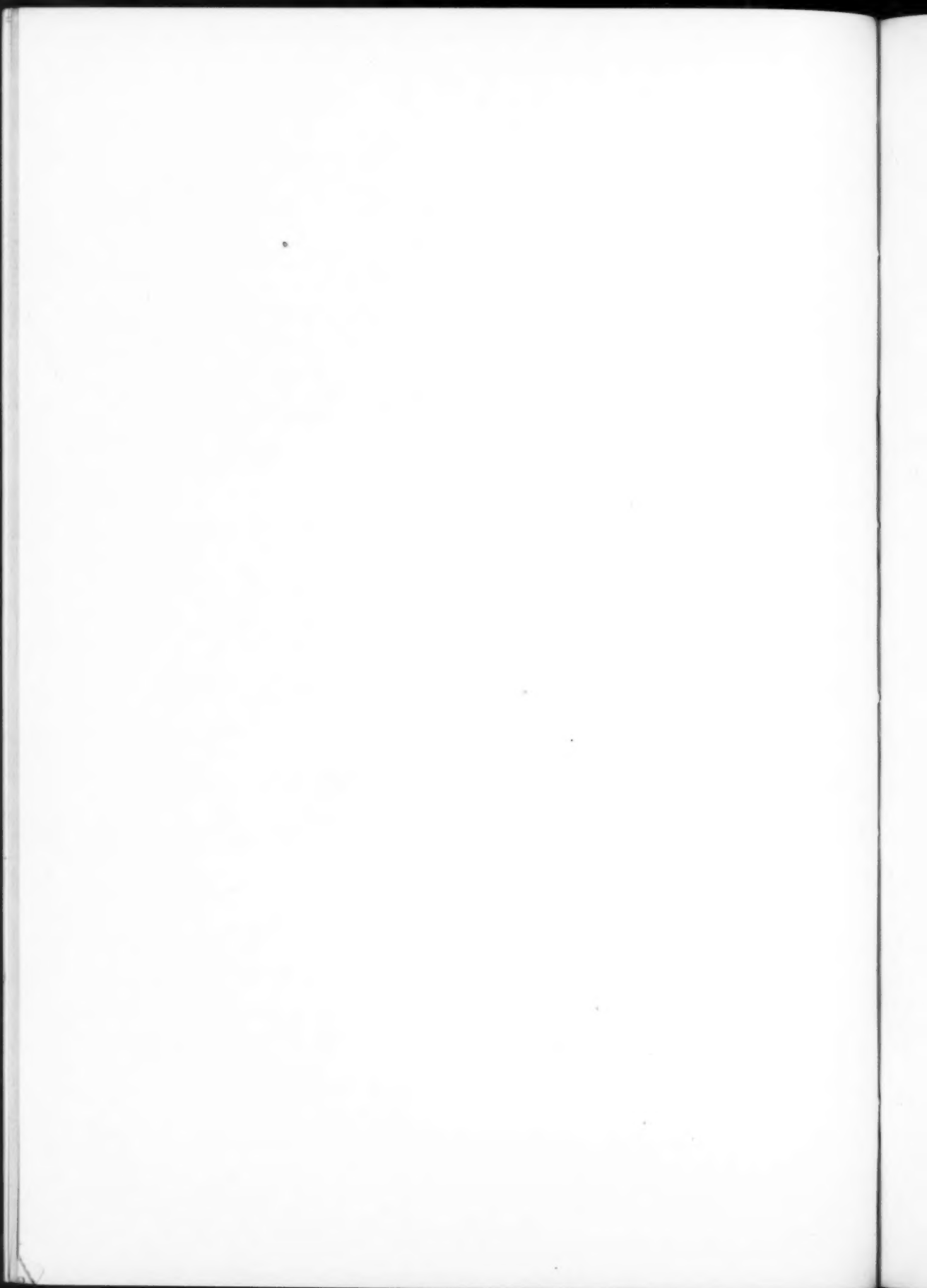
FIG. 2.—Agnew flap in place.



FIG. 3.—Modelling compound impression being made.



FIG. 4.—Compound removed, showing denuded area to be covered with graft.



TREATMENT OF WEBBED FINGERS

on adjoining fingers at one sitting. The whole hand, including the modelling compound, is placed on a splint extending well up the forearm to prevent any extension or flexion of the fingers. We do not dress the case for four days. At the end of this time, we remove the splint and dressings, and with the modelling compound still in place, irrigate the fingers with boric acid and cleanse the skin with green soap. The modelling compound dressing is removed in approximately ten days.

In the acquired type of webbed fingers due to burns, etc., an Agnew flap is often impossible to obtain. In these cases, we make a central division of the web, then take an impression in modelling compound; with the fingers well separated from one another, as shown in figure number three. An Ollier-Thiersch graft is placed over the entire area and the compound is reintroduced over the graft as in the operation for congenital webbed fingers. See figure number four. Here again our successful takes have been very gratifying. In burned hands, wherever possible, we attempt the skin grafting before contracture takes place, assuming the bacteria to be less than five to the field and no hemolytic streptococci present.

In both the congenital and acquired types, massage and stretching, both active and passive are necessary to prevent subsequent limitation of motion.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held April 2, 1923

The President, DR. JOHN H. JOPSON, in the Chair

LANE PLATE HEALED IN PLACE

DR. ADDINELL HEWSON presented a bone attached to which was a Lane plate, healed in. The specimen was found on the dissecting table.

SPINA BIFIDA OCCULTA

DR. JOHN SPEESE reported the case of a man, age twenty-eight years, who was admitted to the Presbyterian Hospital, January, 1920, with the following history: Eight years ago while exercising he fell and struck his back. He felt a severe pain and a distinct snapping, which was accompanied by a sensation of lack of support in the lumbar region. The pain was so severe and so continuous that he was confined to bed for several weeks; the distress was relieved by strapping, although a certain amount of pain persisted. X-ray examination showed a defect in the posterior arch of the fifth lumbar vertebra, due to non-fusion of the laminae and spinous processes. The condition was diagnosed as spina bifida occulta and an operation was advised. This was refused, and for the relief of the pain, a brace was made which supported the spine from the shoulders to the hips. A considerable amount of relief was experienced after the application of the brace, but the pain was more or less constant, although not severe in character. For the past eight years he has carried on his profession as a dentist, although the constant standing has caused more or less persistent backache. Any undue exertion increased the amount of discomfort.

On examination a distinct defect (Fig. 1) was felt in the fifth lumbar vertebra, and over this region there was a crescentic growth of hair.

In January, 1920, an operation was performed by Dr. J. E. Sweet and the reporter. An incision over the vertebræ revealed the defect in the fifth lumbar; the ends of the processes were slightly movable and undoubtedly allowed a certain amount of play, which it was thought would account for the pain complained of by the patient. The ends of the defect were freshened, and brought together by kangaroo tendon, the erector spinæ muscle, which had been detached, was then sutured closely to and over the defect, in order to give all possible support to the area. Immediately following the operation, the patient experienced great relief

SPINA BIFIDA OCCULTA

from his pain. He was able to lie on his back with comfort for the first time in many years. Previously, it was necessary for him to sleep on the abdomen, and he was unable to turn in bed on account of the pain which such motion caused. The wound healed by first intention, and in two weeks the patient was up and about. The use of the brace was advised for several months, in order to promote firm union.

Subsequent history: At the end of two months the brace was discarded and the patient was able to resume his profession with very little discomfort. An occasional attack of backache was experienced, however, if he were indiscreet in exercise or exertion; these attacks gradually diminished until after the lapse of a year, he was able to exercise without experiencing any trouble.

DOCTOR SPEESE said that spina bifida occulta may be defined as a congenital cleft or defect in one or more of the spinous processes or laminae of the vertebrae without an external sac being present. The subject was reviewed in 1921 by Christopher (S. G. O., 1921, 33, 1) from whose article the following facts are abstracted: The incidence of spina bifida occulta has been placed

as high as 5 per cent., but X-ray studies of 1000 consecutive cases disclosed incomplete closure of the vertebral posterior arches in the last lumbar vertebra to be present in 2.3 per cent.

Brickner concludes from his studies that there may be a cleft of varying length or breadth in one or more of the arches accompanied by one of the following conditions:

- (1) A distinct meningocele protruding through the cleft.
- (2) Closure of the cleft by a tough membrane adherent to the overlying skin or non-encapsulated fat and connective tissue.
- (3) Perforation of the membrane by a dense band attached to the subcutaneous tissues externally and compressing the cord structures internally.

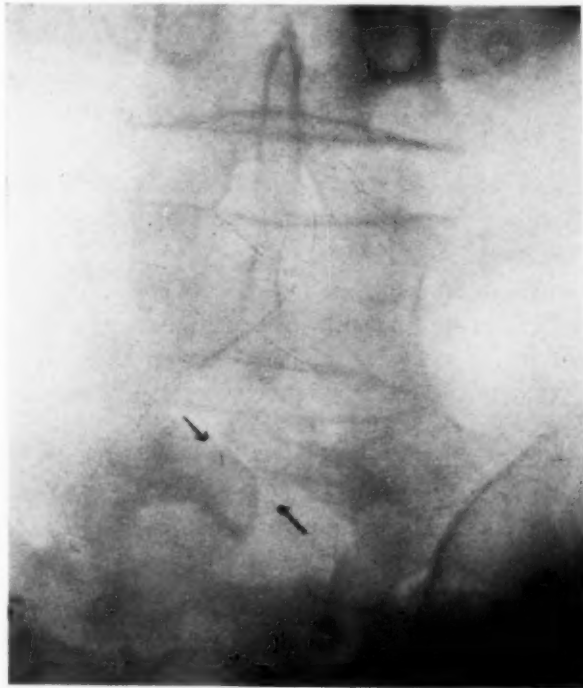


FIG. 1.—Spina bifida occulta.

PHILADELPHIA ACADEMY OF SURGERY

- (4) Lipomatous tissue within the canal concealed by this membrane.
- (5) Bulging of the dura mater.
- (6) An exostosis within the canal compromising the cord tissues.
- (7) A myofibrolipoma extending through the cleft and into the bony canal, disturbing and compressing the cord and its roots.
- (8) Degeneration of the cord tracts.

Hypertrichiasis over the area of the spine affected is present in the majority of cases, but the defect is not always present in cases of hypertrichiasis. Vesical incontinence has been present in a large per cent. of cases, and enuresis in children is common. Foot deformities are variable, and corns and calluses are frequent.

Pain has been inconstant; it may be present in the region of the defect or even referred to the legs.

A very constant physical sign is the presence of one or two sacral dimples. Congenital lipomata are not uncommon, and scoliosis is frequently encountered.

The treatment is of two general types, symptomatic or palliative, and radical. The symptomatic treatment has been of little use and the palliative results, in many cases, have been unfavorable, owing to the fact that the degenerative and neoplastic processes are unremediable by surgical methods. Brickner believes that the cases in which there is a hernia of the spinal roots probably offer the best chance for a good result. His indications for operation are (1) in infants and children with spina bifida occulta without symptoms, in the hope of obviating symptoms, and (2) in adults with symptoms.

Christopher reports a case which is of interest, in that it seems to show that spina bifida occulta is a potential weakness of the body structure, and that an injury by violence to the sacrum or lower lumbar vertebrae may produce, temporarily at least, such symptoms as are found in some of the well-marked cases of spina bifida occulta with symptoms.

The case now reported resembles Christopher's in that violence caused symptoms to develop in the spine, potentially weakened by a defect previously unrecognized and not causing any disability. In this case, however, there was no loss of control of bladder or rectum. The case is of interest also because a comparatively simple operation relieved the backache apparently by fixing the ends of the processes and thus preventing motion.

SUBASTRAGALOID DISLOCATION

DR. JOHN SPEESE showed an X-ray (Fig. 2) and reported the following case of subastragaloid dislocation which he thought of interest in that the dislocation was unaccompanied by any evidence of fracture. The patient, a woman forty-five years of age, was admitted to the Presbyterian Hospital for an injury sustained in falling down a flight

THORACOPUNCTURE

of steps. The right ankle was much swollen and cedematous on the inner side, the skin was tense and stretched over the external malleolus, the foot being inverted. The astragalus could be felt on the outer side of the dorsum of the foot, and there was great pain on any sort of motion.

Under nitrous oxide anaesthesia the dislocation was reduced with very slight effort. The foot was placed in a fracture box until the marked cedema subsided, and a plaster case later was applied. An X-ray examination at this time showed complete reduction, and nine months after the accident the patient reports that she is able to walk without inconvenience or any degree of disability.

THORACOPUNCTURE FOR REMOVAL FROM LUNG OF PENETRATING FOREIGN BODY

DR. CHEVALIER JACKSON presented a man from whose lung he had removed by thoracopuncture a penetrating foreign body. In connection with the presentation he emphasized the fact that without Doctor Manges and his double plane fluoroscope the procedure would have been very dangerous, if not impossible. With guidance in two dimensions absolute precision obviates unnecessary trauma. He did not regard thoracopuncture as the proper procedure for every aspirated foreign body. Any good bronchoscopist can remove such bodies through the mouth with a bronchoscope; but an unskilled bronchoscopist may need a thoracic surgeon to repair the mediastinum—if the patient survives.

DOCTOR SHALLOW said that the whole question of removing foreign bodies from the lungs had been greatly altered by the War. Previous to that time very little was done in a systematic way. During the period of the War, Duval attacked the problem of the removal of foreign bodies from the lungs by resecting a piece of rib, herniating the lung, isolating the foreign body with the fingers, cutting into the lung and removing the foreign body, controlling the hemorrhage with sutures. Marion suggested suturing the parietal and the visceral pleura if they are not adherent. He penetrated



FIG. 2.—Subastragaloid dislocation.

the lung with the finger, isolated the foreign body and passed a clamp along his finger, using the finger as a guide to direct him to the foreign body, and removed it. The bleeding was controlled by a tampon. Mauclore advised the removal of foreign bodies through a small opening. In some cases he resected the rib. He introduced a slender instrument through the chest wall and lung, and, with the aid of a fluoroscope, he removed the foreign body. Marion's technic was modified by Pettit de la Villeon. Under local anæsthesia he penetrated the chest wall and the lung and with the aid of a fluoroscope removed the foreign body. This method is similar to that used by Doctor Jackson in his case.

A case under his own care was associated with a streptococcic empyema. There was a staple in the posterior mediastinum, having been pushed there through the bronchus during an attempt at removal with the bronchoscope. Four ribs over the abscess cavity were resected. After the pus was evacuated it was found that the heart and lung were so adherent to one another that it was impossible to free the lung from adhesions. Under the fluoroscope the foreign body was removed by passing hæmostatic forceps through the lung, after first cutting the thick visceral pleura with scissors. There was not sufficient bleeding in this case to require suture or tampon. The case made a complete recovery.

REPAIR OF LOSS OF BRIDGE OF NOSE AND COLUMELLA DUE TO CONGENITAL SYPHILIS

DR. ROBERT H. IVY reported the case of a boy fourteen years of age who was referred to him by Dr. Benjamin Singer. At various times since birth he had had outbreaks of typical syphilitic lesions. Eight years ago ulceration in the nose resulted in loss of cartilage and bone. He had also been treated for interstitial keratitis. He had active anti-syphilitic treatment until a short time before first seen by the reporter. At this time no active lesions were present and the Wassermann reaction was negative. Examination of the nose showed typical depression of the bridge due to loss of septal cartilage, the skin over the bridge being intact and freely movable. The entire cartilaginous septum, inferior turbinated bones, and columella were gone.

July 7, 1922, under ether at the Polyclinic Hospital, two vertical parallel incisions, 1 cm. apart, were made through the full thickness of the middle of the upper lip, including the mucous membrane. The mucous membrane was removed from the lower end of this flap, and the raw surface sutured to a previously freshened area just beneath the tip of the nose, the columella being thus reconstructed. The divided halves of the lip were then brought together and sutured. Restoration of the columella by this means was first described by Blandin in 1836. No visible deformity of the lip results.

August 25, 1922, the bridge of the nose was restored by a piece of the eighth right costal cartilage inserted beneath the skin through an incision made in the glabellar region.

ANKYLOSIS OF MANDIBULAR JOINT

Healing occurred normally, and the treatment resulted in marked improvement in the appearance of the patient.

DR. JOHN B. ROBERTS mentioned a case in which he used a peg of cartilage, shaped like a nail, to keep the whole of the nose elevated when the columella lacked rigidity.

The point of the seventh or eighth rib cartilage was used and thrust through a slit made in the columella so that the point of the cartilage rested on the upper jaw at the nasal spine.

ANKYLOSIS OF MANDIBULAR JOINT—ARTHROPLASTY

DOCTOR IVY reported the case of a man, aged twenty-two years, who until 1920 never had any trouble with his jaw. In 1920, he had double pneumonia followed by empyema. Complicating this was necrosis of the sternum at the level of the third rib. He had rib resection and drainage on both sides. During this illness there was also a metastatic arthritis of the right mandibular joint, which did not go on to suppuration, but which left him with limited motion of the jaw.

In June, 1921, still unable to open the jaws more than 1 cm., an impacted lower right third molar tooth, regarded as a possible contributing factor in the ankylosis, was removed, and while the patient was under the anæsthetic, the jaws were forcibly opened to a width of about 2 cm. between the upper and lower incisors. Following this, and division of peri-articular adhesions in February, 1922, the former condition of almost complete ankylosis returned.

In October, 1922, it was found that the upper and lower incisors could not be separated more than 1 cm., and that attempts to force the jaws farther apart produced pain in the right mandibular joint. In opening, the mandible seemed to move toward the right side, with the fixed right condyle as a pivot. No outward facial deformity, such as is seen in cases of ankylosis occurring before full growth of the mandible, was visible.

October 13, 1922, at the Polyclinic Hospital, under ether, an incision was made through the skin, beginning below just in front of the lobe of the right ear, passing vertically upward to a point opposite the upper attachment of the pinna, then extending upward and forward in a curved manner to the level of the top of the pinna, then downward and forward to end at a point about 3 cm. in front of the upper attachment of the pinna. The skin flap thus outlined was then turned down. A flap of superficial fascia with the same outlines as the skin flap was now made, the posterior attachment of the masseter severed from the zygoma, and the neck of the condyle exposed. With a narrow gouge, the neck of the condyle was divided, about 0.5 cm. of bone being removed. This permitted free opening of the jaws to the full extent. The end of the flap of superficial fascia was fixed with catgut sutures between the bone surfaces, to prevent them from reuniting, and the skin flap was sutured back in its original position, a temporary rubber dam drain being inserted at the lower angle to prevent accumulation of blood. A wooden wedge was wired between the teeth of the right side to keep

the mouth open, but this gave so much discomfort that it was removed the next day without untoward results.

The patient made an uninterrupted recovery and was discharged from the hospital on October 18.

Since that time he has had full use of the jaw, with maintenance of ability to separate the upper and lower teeth to a normal extent.

Operations for the relief of bony ankylosis of the mandible are not new. In 1855, Esmarch recommended removal of a wedge-shaped piece of bone from the angle, and Wilms of Berlin first successfully performed the operation in 1858.

The first removal of the condyle was performed by Humphry, in 1856. In 1883 Heath resected the neck of the condyle through an incision in front of the ear. Similar operations are described by Gross (1874), Mears (1883), and other American surgeons.

Coming to more recent times, Blair, in *Surgery, Gynecology and Obstetrics*, 1914, vol. xix, p. 436, gives a very exhaustive analysis of 212 cases including several of his own. In 1910, before the St. Louis Medical Society, Blair first presented the operation used in the case reported here. The incision gives free access to the joint and at the same time avoids important seventh nerve branches. With the angular incision described later by Murphy (*Jour. A. M. A.*, 1914, vol. lxii, p. 1783) there would seem to be more danger of paralysis of the orbicularis palpebrarum and certainly of the occipito-frontalis.

DR. GEORGE M. DORRANCE said that he had seen that day two cases in which he had performed arthroplasty within six months. Not only was bony ankylosis present in these cases but the muscles were short and fibrous, much more so than in the normal muscles. In looking over a number of cases he had been impressed with the fact that they recur. Something over a year ago he started in with mechanical exercises of various types. In the two cases now referred to the exercises had been of great value. The ankylosis had existed in these cases from twelve to fourteen years before operation. They had started to ankylose between eight and ten years of age so that the bone was not developed as the adult bone would have been.

The most important thing is that these exercises have kept the distance as long as they were used. When they were stopped, contraction again set in. In all these cases of long duration one should not expect these muscles to get back their function again any more than one would expect an arm to do so after it has been in a sling a long time.

DR. A. BRUCE GILL said that he had operated upon two cases of ankylosis of the jaw. In June, 1919, a boy of seventeen years from Birmingham, Alabama, was brought to Philadelphia by his father because of ankylosis of the jaw which had existed since early childhood. The father had been away from home during the boy's infancy and could give no history of the cause or development of the ankylosis. There was a history, however, of an osteomyelitis of the femur with sinuses which discharged for several years.

ANKYLOSIS OF MANDIBULAR JOINT

The boy presented a very marked retrognathism, or under-development of the lower jaw. His lower teeth in front were fully one-half inch behind the upper teeth, and by means of this orifice the boy was able to introduce meat and other articles of a general diet into his mouth, where he partially masticated them with his tongue before swallowing. There was no perceptible motion of the lower jaw either side-wise or up and down. They were unable to tell by examination, or by means of any inequalities of the two sides of the face, or by X-ray examination which temporo-mandibular joint was ankylosed, or whether both were involved. A small linear scar about one-fourth inch in length in the region of the left joint suggested that an incision had been made at some time, possibly for metastatic abscess following the osteomyelitis of the femur.

Doctor Ashhurst examined the case with him and assisted in the operation. An incision was made along the lower border of the zygoma, going directly down to the periosteum. The incision was carried downward for about an inch in front of the ear. The soft tissues were retracted downward, exposing the region of the joint. No line of demarcation of the joint was evident. There was bony union of the entire width of the mandible, including condyle, coronoid, and sigmoid fossa, with the glenoid fossa and the zygoma. The ramus of the jaw was divided with biting-forceps and osteotome across its entire width below the zygoma without injury to neighboring vessels or nerves. The jaw could then be opened about an inch. When the jaw was closed there was a gap of about one-quarter of an inch between zygoma and mandible. The wound was closed and healed promptly.

A hard rubber screw was used during the after-treatment to force the mouth open more and to maintain the opening, but its use was more or less painful and caused loosening of the teeth. Many of the back teeth were unerupted.

The boy left for home at the end of a month able to open his mouth about one inch and to close it again. There was no soreness in the muscles of mastication nor about the joints.

He returned to Philadelphia at the end of five months because of a relapse and inability to open the mouth.

A second operation, similar to the first, was done. Bony ankylosis was present. Three-eighths of an inch of bone was excised. The mouth could then be opened an inch, when it was observed that the bony gap increased to beyond a half-inch. A free transplant of fat from the thigh was then placed between the bones and wound was closed.

Following this operation several rubber wedges of different sizes were employed to keep the mouth open. It was found, however, that there was no tendency to relapse, as after the first operation, but that there was constant improvement in the use of the jaw and without pain. Voluntary motion increased from three-fourths to five-fourths of an inch during the following month. The patient reported some time after his return home that he had good motion in his jaw and that he was entirely satisfied.

The second case was that of a colored girl of fourteen years with

complete ankylosis dating from infancy, cause unknown, marked retrognathism, and again no sure indication by inequality of the face or by X-ray examination as to which joint was ankylosed. Operation was performed on the right side, when a bony ankylosis between mandible and zygoma was found extending from the condyle almost to the tip of the coronoid process, with obliteration of the sigmoid notch. With osteotome and mallet a gutter was cut across the mandible just below the zygoma, and the opening was enlarged with rongeur forceps to a width of five-eighths of an inch. The jaw could then be opened almost an inch. A free fat transplant from the thigh was placed between the bones, and the wound was closed.

A dental instrument consisting of hinged plates for the upper and lower teeth with a screw was obtained and used in the after-treatment.

This patient gained steadily in the use of her jaw and obtained a splendid result.

From these cases he learned that it is better to interpose soft tissue between the raw bony surfaces to prevent relapse, and that one is not always able to tell by any means of examination on which side the ankylosis is present. The operation by means of the method described is easy and is free of danger of injury to vessels and nerves if one uses precaution and gentleness.

DR. J. T. RUGH said that last year he had the pleasure of seeing one of the cases which Doctor Mears did many years ago. The patient is now a physician in Western Pennsylvania. He still has excellent function in the jaws as the result of that operation. It seemed to him that one of the greatest things that Murphy has shown has been the uncertainty of arthroplasty. Subsequent studies of his cases show recurrence of the ankylosis, not only in the jaw but in other parts of the body. The results of arthroplasty can not be estimated until three or four years have passed. This result of Doctor Ivy's is beautiful, but it is only at the end of seven or eight months. The speaker wanted to know what the result is at the end of three or four years. All surgeons know what it is to have recurrences when dealing with bony ankylosis.

DR. JOHN H. JOPSON said that these are not very common cases. Dr. J. Ewing Mears, a former President of the Academy, was a pioneer in this field, and showed several cases at a meeting many years ago. Mears' work ought to be kept in mind and the part that he played in helping what seemed almost an incurable deformity at that time. John B. Murphy's report before the American Surgical Association in 1914 also should be recalled. The speaker had operated on and exhibited one case here, a case of double ankylosis, treated by the Lilienthal method, including osteoplastic resection of the zygoma. The cosmetic result was inferior to that obtained by Doctor Ivy, which is the best he had seen; but the functional result was excellent. If the ankylosed joint is thoroughly resected and this followed by an arthroplasty along modern lines, one should not expect a recurrence.

DOCTOR IVY, in closing discussion, said that the determination of which side

TREATMENT OF WEBBED FINGERS

is ankylosed generally presents little difficulty. In cases of long standing a careful study of the deformity due to lack of use will frequently determine this point. The ramus of the mandible on the ankylosed side is usually shorter vertically, giving that side of the face a full, rounded appearance, whereas the opposite side is flattened. Mistakes, however, have frequently been made, the flattened or sound side being opened first because it looks more abnormal than the other. The X-ray generally gives very little aid on this point.

If the jaws do not open by free removal of bone on both sides, the remaining ankylosis is due to contracture of the soft tissues and these must then be divided or removed as far as is necessary. One case seen in the army was due to myositis ossificans of the masseter muscle, requiring complete excision of the muscle.

It was undeniable that final conclusions as to the result of operation in these cases could not be reached until at least two years have elapsed. They practically all require the use of muscle exercisers to maintain mobility.

TREATMENT OF WEBBED FINGERS

DRS. G. M. DORRANCE and J. W. BRANSFIELD read a paper with the above title, for which see page 532.

DR. A. BRUCE GILL said that he had operated on a few cases of congenital syndactylism, and obtained fair results by a plastic operation. The skin on the dorsum of the hand is very loose, and a triangular flap with the apex at the web of the fingers can be drawn downward to cover not only the raw surface between the fingers, but also part of the side of a finger.

One should not operate on infants or young children probably before the age of ten or twelve years, because the scar on the lateral surface of the fingers contracts and causes a lateral bowing of the fingers. The fingers are so small and the scar so relatively large that deforming contracture cannot be prevented.

DOCTOR DORRANCE said he had had no experience at all with children. The simplicity and success of this method came to his notice in the army, after explosions where the whole hand would be burned. They put these grafts on and thought they had remarkably good results. It is a local anaesthesia job, simple and easy. The only trouble with flaps from the abdomen is that they are liable to take on fat and for this reason they had not been entirely satisfactory to him. They had been making their grafts a little thicker recently, they are half-way between a Wolf and an Ollier-Thiersch method. In burn cases this method has been particularly satisfactory.

DR. JOHN H. JOPSON said that he had found the Agnew or Zeller operation a good one, but in operating in young children it has the fault that it does not provide for early healing of the lateral incisions on the fingers beyond the web. Scars at these sites do not grow proportionately to the growth of the hand, and the resulting contraction draws down the interdigital fold of skin and results in partial relapse. The method recommended by Doctor Dorrance obviates to some extent this difficulty.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY

Stated Meeting Held April 11, 1923

The President, DR. JOHN A. HARTWELL, in the Chair

DISLOCATION OF SCAPHOID OF TARSUS—OPEN REDUCTION

DR. JOHN A. McCREERY presented a man, aged thirty-three, who was admitted to the First Surgical Division, Bellevue Hospital, March 8, 1921. Shortly before admission he had fallen 18 feet, landing on the ball of the left foot. The fall was followed by intense pain and inability to walk. When seen shortly after admission the left foot was swollen. There was distinct dorsal prominence in the region of the scaphoid. There was .5 cm. shortening in the measurement from the head of the first metatarsal to the tip of the internal malleolus as compared with the opposite side. X-ray showed dislocation of the scaphoid dorsally with a fracture of the tuberosity, the latter fragment displaced somewhat backward.

Two attempts at closed reduction were made without success, and an open reduction was performed four days after injury. The scaphoid had been broken into two pieces by a vertical line of fracture which separated the tuberosity from the body. The latter was dislocated on to the dorsum of the foot, the displacement being in part a direct displacement upward, but chiefly a rotation on the transverse axis of the bone, so that the articular facets for the cuneiform bones were directed upward and forward at an angle of about 60 degrees from the normal position. The dorsal ligament uniting the scaphoid to the cuneiform bones had been torn from the latter. The plantar ligaments were apparently intact. The inability to effect a closed reduction was apparently due to the impossibility of drawing the cuneiform bones away from the articular surface of the astragalus to which they were approximated and also to inability to rotate the scaphoid by external pressure. Reduction was easy after the internal cuneiform had been displaced distally with a periosteal elevator, thus opening the space between the astragalus and cuneiform bones, and allowing the scaphoid to be rotated into place by direct pressure. The displacement could be easily reproduced by extreme plantar flexion of the metatarsals accompanied by pressure upward in the long axis of the foot. No attempt was made to unite the tubercle of the scaphoid to the body of the bone. The thin dorsal ligaments were repaired with chromic catgut and the wound closed.

The wound healed without infection, and the patient was discharged two weeks after operation on crutches, with a plaster case extending from toes to knee. The case was maintained for six weeks and then a plate

PENETRATING ULCER OF STOMACH

was made and worn for about four months, when it was discarded because of complete absence of symptoms in the foot.

At the present time, two years and one month after operation, the man has no pain or other disability, and has apparently normal motion and a normal arch.

FRACTURE OF CARPAL SCAPHOID AND DISLOCATION OF SEMILUNAR

DR. JOHN A. VIETOR presented a woman thirty-five years of age, who was admitted to Doctor Pool's service at New York Hospital in February, 1920, with a history of having fallen off a bicycle one year previously and injuring both wrists. For this she was treated in a hospital in New London, where her wrists were put up in plaster-of-Paris for five months. On admission to New York Hospital she complained of pain, tenderness and inability to use the left wrist. Physical examination showed a slight silver-fork deformity of the left wrist with a marked rounded prominence over the anterior carpal region and some tenderness. The maximum tenderness was on the dorsal surface of the wrist just below the middle of the articular surface of the radius. There was no tenderness in the anatomical snuff-box. There was marked limitation of motion especially in flexion. Both adduction and abduction were painful. The diagnosis was unreduced Colles' of left wrist with fracture of scaphoid and dislocation of semilunar on right side. Operation was decided upon under general anaesthesia. The following procedure was followed: Excision of scaphoid for fracture, excision of semilunar for dislocation. Anterior incision on the outer side of the palmaris longus exposing the median nerve. Proximal end of scaphoid and semilunar readily removed. Wound closed without drainage and the forearm and hand immobilized. In twenty-four hours the splint was removed and the patient discharged in five days. She was referred to the out-patient department for baking and massage and active motion. On the nineteenth day after operation there was considerable flexion and extension. There was no longer any limitation in abduction and adduction. She was discharged from the out-patient department in five weeks. Examination made three months later revealed that flexion was normal; at six months there was no limitation of flexion, but slight limitation of extension. There was no loss of adduction, abduction, supination or pronation.

This case is of interest first on account of the relative frequency of the condition. Secondly, it is generally diagnosed and treated at first as sprain. Thirdly, treatment by conservative measures is usually unavailing. Fourthly, dislocation of the semilunar is of frequent occurrence. The fifth and last reason for interest in this case is that good post-operative results followed.

PENETRATING ULCER OF THE LESSER CURVATURE OF THE STOMACH—RESECTION BILLROTH I

DR. RICHARD LEWISOHN presented a man, fifty-two years old, who was admitted to Beth Israel Hospital on February 26, 1923, suffering

from a penetrating ulcer of the lesser curvature. X-ray examination showed a typical Haudeck's niche. Ewald: free HCl, 56, total acidity, 84.

The operation was performed on March 3rd. An upper median incision revealed a penetrating ulcer of the lesser curvature, three-quarters of an inch in diameter. A Billroth I resection was performed, using Haberer's technic. The abdomen was closed in layers without drainage.

Microscopical examination: benign ulcer.

The patient made an uneventful recovery. He was discharged March 26th. Ewald test-meal taken before his discharge showed: free HCl, 0, total acidity, 24.

X-ray examination showed a slight six-hour residue, which will disappear with the return of the tonicity of the stomach.

DUODENAL ULCER—RESECTION BILLROTH II

DR. RICHARD LEWISOHN presented a man, forty years old, who was admitted to Mount Sinai Hospital, February 20, 1923. The patient has complained of severe epigastric pain for the last two years. The attacks were so severe that the patient insisted on an exploratory laparotomy in spite of negative X-ray findings.

Ewald test-meal: free HCl, 32, total acidity, 64.

The abdominal incision through the right rectus muscle revealed a small ulcer (size of a one-half finger nail) on the anterior wall of the duodenum, just beyond the pylorus. The duodenum was bound down by adhesions. After splitting of the hepato-duodenal ligament the duodenum was liberated. The gastric vessels were ligated and the stomach was divided about midway between the cardia and pylorus. The duodenum was dissected away from the pancreas by sharp dissection and divided just below the site of the ulcer. The duodenum was closed in three layers, using the pancreas capsule for the second and third layers. Closure of the proximal end of the stomach in three layers. Posterior retro-colic suture gastro-enterostomy. Closure of abdominal wall without drainage. The patient made an uneventful recovery.

Microscopic examination: benign ulcer.

Ewald test-meal taken three weeks after the operation showed: free HCl, 5, total acidity, 12.

The patient was discharged on March 16th.

RESECTION OF STOMACH IN CHRONIC GASTRIC AND DUODENAL ULCERS

DR. RICHARD LEWISOHN read a paper with the above title, for which see page 507.

DR. GEORGE WOOLSEY said that in regard to gastro-enterostomy, he thought a distinction should be made between ulcers of the stomach and those of the duodenum. He believed Doctor Lewisohn was right in regard to his position as to gastric ulcers. A year ago the speaker wrote a paper which he read in Washington before the American Surgical Association on "The

RESECTION OF STOMACH

Choice of Operation for Gastric Ulcer in View of the Late Results." In the last seven years he has done gastro-enterostomy in only 20 per cent. of gastric ulcers operated on. He prefers resection for gastric ulcer, and yet, in looking over the end results of gastro-enterostomy for gastric ulcer, he was surprised to find the results so good, 80 per cent. being good results. This is to be expected where there is pyloric ulcer with marked stenosis, but in one case where the ulcer was near the middle of the posterior wall he got a report nine years afterward that the patient had been well and working hard ever since the operation. Today, ulcers of that kind would undoubtedly be resected. As to the method of resection, Doctor Lewisohn's cases are confined to the two Billroth methods. Doctor Woolsey had never done the Billroth I except in one case, and in that he had to reoperate later on and add a gastro-enterostomy. But when the technic is improved, as in the pictures shown by Doctor Lewisohn, it might offer good results in a selected group of cases. He had used the Billroth II in eight cases, and they included the only mortality he had had in gastric resections; but this was not due to the method but to the condition of the patients. He was inclined to use and recommend the Polya technic of resection rather than the Billroth II; it is easy, takes less time, and the end results are even better in his experience. The part of the stomach that takes the place of the pylorus contracts down after the operation so that examination with the fluoroscope some months later shows what looks like a normal stomach. He had not seen any jejunal ulcers following cases of gastric resection. As to the question of resection in duodenal ulcer, he had done a very few; he hesitated to subject these patients to resection for he believed the ultimate results to be little if any better than after gastro-enterostomy. The bugbear of jejunal ulcer always looms up, but he had not had as much as 3 per cent. occur in his cases; in fact less than 2 per cent. As Doctor Downes said, the Von Eiselsberg's operation gives the largest percentage of jejunal ulcers, but it is seldom used now. For duodenal ulcer gastro-enterostomy is still Doctor Woolsey's operation of choice, and he thought the tendency to condemn it is getting to be a habit. It is like a pendulum which is swinging one way and after awhile it will swing the other. The cases he had operated upon had been followed up very carefully and fluoroscoped and the results have remained for long periods of time very satisfactory.

DR. CHARLES H. PECK agreed with Doctor Lewisohn in regard to the question of gastric ulcer, and at the present time most surgeons seemed to believe they should be excised by one method or another. But he had not applied the same principle to duodenal ulcer for it seemed to him that the majority of these did well with simple gastro-enterostomy. Very few jejunal ulcers are seen, and some of those were due undoubtedly to the type of suture used or to the technic rather than to a tendency for the ulcer to form because only a gastro-enterostomy was done. In the speaker's last series of cases there was only 2.5 per cent. jejunal ulcer. He had never done the Billroth I and

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had resected for few duodenal ulcers and then usually when hemorrhage was severe or he was afraid of perforation. He believes that the great majority are healed in a month's time after simple gastro-enterostomy. Gastric ulcer can often be treated by local excision, but one must be sure to destroy the entire ulcer. Doctor Peck had not had much experience with the Polya method of resection, having stuck to the Billroth II in those cases that required resection. He believed that Doctor Lewisohn had struck the right note in urging resection as applied to gastric ulcer, but was inclined to think he was advocating more radical methods than were necessary if he attempts to apply the same principle to duodenal ulcers.

DR. JOHN DOUGLAS said that the ultimate conclusion as to the best operative procedure is going to depend on the late reports from the follow-up clinic in these patients. As Doctor Lewisohn said, every surgeon has a number of cases in which gastro-enterostomy, or gastro-enterostomy with excision has produced results that are not good. He was surprised last fall in following up the cases at St. Luke's at the favorable results following gastro-enterostomy. There were 65 duodenal ulcer and 50 gastric ulcer cases in which various operations had been done. Where gastro-enterostomy was done, in 52 cases of duodenal ulcer only three were failures, and in 28 cases of gastric ulcer one is reported as unimproved. A certain number were not perfect cures, but they were much improved. It was surprising to find this total number of good results, in view of the frequent criticisms of gastro-enterostomy. As far as the after results of these extensive resection operations are concerned, while many of the excision operations are being done at the present time, few have sufficient figures over a long enough period to judge by. Doctor Lewisohn's cases have gone from 1920 to 1923 only. One other point which has not been stressed; an important reason for doing the excision operation for gastric ulcer, either in part or extensively, is the fact that so many of these gastric ulcers are carcinomatous at the time of operation and cannot be so recognized or develop carcinoma later. Two of those at St. Luke's which were at first thought to be cured died of carcinoma of the stomach one or two years later. This extensive resection will prevent that. But it is not necessary to resect half the stomach for a small ulcer in the region of the pylorus, especially if on the duodenal side, that can easily be excised.

DR. ALEXIS V. MOSCHCOWITZ said that even at the risk of being called old-fashioned, he would not like to agree with all of the statements of Doctor Lewisohn. He believed that the whole subject could be summarized about as follows: Even the most enthusiastic internist will agree that the percentage of surgical cures, even after the simpler operations, is about 70 per cent. On the other hand, the most enthusiastic surgeons even claim to curing 90 per cent. The actual truth probably lies somewhere between these two. In other words, the percentage of cures after simple surgical procedures is about 80 per cent. If one analyzes the whole problem, follows the discussions as they take place from time to time at various medical meetings, it is about as follows: The

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surgeon is proud of his 80 per cent. of cures, while the internist is proud of the 20 per cent. of surgical failures. After listening to Doctor Lewisohn's paper, it appears to Doctor Moschowitz that even the surgeon is now proud of his failures.

It appeared to the speaker that it is wrong to group together the ulcers of the duodenum and the ulcers of the stomach. In his experience the ulcers of the duodenum and the ulcers of the stomach near the pylorus, particularly those accompanied by stenosis, are very amenable to cure by the very simple operation such as gastro-enterostomy and pyloric exclusion. In dealing with an ulcer of the stomach far away from the pylorus this method is insufficient, but excision of the ulcer serves very well. Whether or not the method of Haberer, which is really only a modification of the Billroth I, is going to be the last word in the treatment of gastric ulcer, the speaker for the present still had some doubt.

Stated Meeting Held April 25, 1923

The President, DR. JOHN A. HARTWELL, in the Chair

EMBOLUS OF AXILLARY ARTERY

DR. MORRIS K. SMITH presented a woman, fifty-five years of age, who underwent a vaginal hysterectomy for carcinoma of the body of the uterus, March 14, 1923, at St. Luke's Hospital. On the ninth post-operative day at 5.40 A.M., she was seized with sudden severe pain in the left hand running up to the shoulder. She could not move the fingers or hand and noted that the hand was blue. She received two hypodermics for pain before he saw her six hours later. At this time she complained of pain and a feeling of deadness in the extremity. The hand was quite blue, not notably swollen. She could only make the slightest movements with the fingers and wrist. The pulse could be felt in the upper end of the axillary artery just distal to the clavicle but not in the lower axillary or brachial.

Six hours later the pulse could be obtained to the lower end of the brachial, and the color of the hand was much improved. For several days there was a fulness and some sensitiveness in the bend of the elbow where the pulse was lost. Pain lessened and function improved steadily. On the tenth day after the lodgement of the embolus, slight pulsation could be felt in the radial. Two days later the radial pulse was distinct but less than on the other side. At this time motion was free in the hands and fingers. The hand was cool. She had little pain but complained of numbness and prickling.

An X-ray of the chest taken a few days after the development of the complication was negative for aneurism, cardiac or pulmonary pathology.

The past history of the patient is of interest. Twelve years ago she had an appendectomy at another hospital. Two days later she states that her right leg became white although without pain. This condition, according to her account, gradually extended upward, and on the seventh

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day post-operative amputation was done through the thigh. Six years ago she had a herniotomy without mishap.

DR. H. E. SANTEE said that one month ago he discharged a case quite similar to this. The patient had been transferred from the medical service with a history of subsiding pneumonia. A sudden pain had appeared in the right brachial region with loss of pulse, and a cold, anemic hand. Twenty-four hours later sudden pain appeared in the right upper quadrant. The blood count was 18,000, temperature between 100.5° and 101° . There was marked tenderness and rigidity. The question of mesenteric thrombosis or renal infarction was taken into consideration. The urine showed no blood. The condition of the patient precluded active procedure. The pain in the right upper quadrant subsided, and at the end of two and a half weeks pulse appeared in the right radial. As this case progressed it showed a tendency toward diarrhoea and blood in the stools, but in five weeks he was discharged apparently well.

UNREDUCED SEPARATION OF LOWER RADIAL EPIPHYSIS. (2 CASES)

DR. MORRIS K. SMITH presented a lad fifteen years of age who hurt his right wrist in June, 1921. When seen two weeks later in the Out-Patient Department of St. Luke's Hospital, he had a marked silver-fork deformity of the right wrist. He could use the hand quite well and complained principally of the crooked wrist. X-ray showed a backward displacement and tilting of the lower radial epiphysis. Attempted reduction under anæsthesia was entirely unsuccessful. Nine months later the deformity had disappeared clinically and largely radiographically. There was no shortening and no loss of function. Today there is no apparent difference in the wrists.

A second patient was a girl, ten years of age, who fell on her right hand August 5, 1921. When seen in the Out-Patient Department of St. Luke's Hospital, 11 days after the injury, she presented a silver-fork deformity of the right wrist with hyperextension and limited flexion. There was no tenderness. X-ray showed posterior dislocation and tilting of the lower radial epiphysis. Attempted reduction under anæsthesia was unsuccessful. Reëxamination five months later showed a remarkable improvement, and at present the wrists appear the same clinically, while radiographically there is little to show for the old injury.

UNUNITED FRACTURE OF FEMUR

DR. FORDYCE B. ST. JOHN presented a man seventy-five years of age, who had been admitted to hospital on account of obstruction of the colon due to malignant neoplasm, demonstrated to be in the proximal portion of the transverse colon and hepatic flexure. A simple appendicostomy was performed under local anæsthesia with complete relief of symptoms.

He was presented to the society, however, because of the following history:

In 1873, fifty years ago, the patient fractured his right thigh and was admitted to Bellevue Hospital. For two weeks he was

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treated in bed with weights attached to the leg by means of a cord running over a pulley at the foot of the bed. At the end of that time, a plaster splint was applied for several weeks and then removed, at which time patient sustained a fall while being lifted into a chair and refractured the femur. From that time on union did not seem quite satisfactory, but patient used it in an active life until a brace was suggested by Doctor Bull. This or similar braces he has worn ever since with but little discomfort and interference with his work.

He now presents marked shortening, pseudoarthrosis and a rather interesting X-ray. The X-ray shows no evidence of bony union, marked overriding and bone atrophy. It is of further interest that even with the fibrous union he walks without the brace although with a marked limp. It is not practical, however, for him to carry on without the brace. It is of much historic and scientific interest to study a fracture with pseudoarthrosis fifty years after the injury.

A second patient presented by Doctor St. John was a man, twenty-six years of age, who was admitted to the Presbyterian Hospital, September 19, 1921. Two months before admission he had sustained a fracture of the left femur, tibia and fibula. For three and one-half weeks he was treated by traction in bed, at which time traction was removed and a plaster spica from umbilicus to toes of left foot applied. He was then allowed to go to his home. Two months after the injury the plaster was removed and marked shortening with non-union of femur, tibia and fibula noted. He was then referred to the Presbyterian Hospital.

Upon admission he presented a marked deformity at the middle of the left thigh, where the lower end of the upper fragment of the femur was readily felt subcutaneously with apparently no musculature intervening. There was a shortening of approximately 10 cm. and clinically no union at the site of fracture. Angulation mesially existed in the lower third of the left leg at the site of fracture of tibia and fibula. At this point there was also motion present but to a lesser degree than in the femur. Passive motion at the knee was limited to 10° (170° - 180°). There was no active motion at the knee. There was complete loss of function in attempting to dorsi-flex the foot at the ankle or extend the toes. The whole extremity showed marked atrophy, the skin was in fair condition; there were no areas of ulceration or necrosis.

Treatment.—Four days after admission skeletal traction was instituted by means of ice tongs with the thigh and leg in overhead suspension, the leg being increasingly flexed and extended on the thigh by the patient. Skeletal traction maintained for 67 days, 35 pounds for first 10 days, then 25 and eventually 20 pounds as an average. Simple suspension, with knee motion encouraged, following this for 60 days, then all apparatus removed with patient in bed for 2 weeks, following which he began using crutches. Six months after admission, 8 months after injury, patient was walking well on crutches and was discharged. Massage every other day was carried on during the above period.

Now 21 months after injury:—the patient's economic status is

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100 per cent., i.e., he carries on his work as an automobile mechanic uninterruptedly.

The case is presented as a long interval result in a complicated multiple non-united fracture of the femur, tibia and fibula in which the femur fracture consisted of four fragments, the largest about 10 cm. long between and unattached to the upper and lower extremity of the bone, and as another demonstration of good functional result with poor anatomical position. One feels that the decision to use skeletal traction is well justified by the result.

DR. H. H. M. LYLE spoke of a similar case with a double fracture of the femur that he treated ten years ago. He had not seen the man since 1914, until he turned up the other day with an old gunshot wound of the arm. Skeletal traction with 50 pounds weight had been applied and a perfect functional result obtained. This man had gone through the late campaign with the First Division until he was wounded in the right arm during the Argonne-Meuse offensive.

DR. JOHN A. HARTWELL hoped that the case reported by Doctor St. John would show the wisdom of utilizing to the utmost methods which grant to the patient good functional use of the limb at the least possible risk.

FRACTURE OF SURGICAL NECK OF HUMERUS

DR. JAMES N. WORCESTER presented a man, aged thirty years, who was admitted to Reconstruction Hospital, November 14, 1922, with this history: Six weeks before admission he fell a distance of three stories. He was taken to Bellevue. A diagnosis was made of a fracture of the surgical neck of the humerus. He was there for six weeks and discharged, at his own request, on November 13. While there he was treated with suspension and traction. He says that his arm was at an angle of about 45 degrees abduction and the forearm was suspended straight up and down.

Physical examination, November 15, showed a marked prominence of the shoulder with a concavity below the shoulder at the outer surface. Active motion is very limited with practically no abduction or external rotation: Passive motion is limited to a very few degrees in the same planes. Union is apparently solid.

X-ray shows fracture of the surgical neck of the right humerus, the upper fragment markedly abducted, with greater tuberosity in contact with acromion process. The fractured surface points almost directly outward. The lower fragment is displaced inwardly and anteriorly and there seems to be no contact between the two fractured surfaces. There is considerable callus, with lateral union.

On account of the apparent impossibility of attaining rotation or abduction with the existing mal-union, open operation was decided upon.

At operation, November 20, 1922, the position of the fragments was found to be exactly as in X-ray. A considerable amount of soft callus was present. On chiseling the fragments apart, it was found that, with the arm in abduction and marked external rotation, the two fractured surfaces were brought into contact.

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Post-operative Treatment.—The arm was suspended in a position of extreme abduction and external rotation and ten pounds of traction used.

X-ray of November 27 shows that there is still a slight internal displacement of the lower fragment, but that the line with the head is sufficiently good to insure proper motion. The patient was allowed out of bed on the 24th day and was discharged December 20, 30 days after operation. Active motion was started immediately after operation, and heat and massage were used throughout. On discharge from the hospital he still had some limitation of motion.

The case was shown, not to illustrate the satisfactory result, but to emphasize the importance of marked abduction and external rotation in the treatment of high fractures of the humerus. Also, to show the remarkably quick union which is obtained under the suspension and traction treatment.

TENDON TRANSPLANT FOR DROP WRIST

DR. JAMES N. WORCESTER presented a man, aged twenty-eight years, who was admitted to Reconstruction Hospital, February 25, 1922, with a history that in September, 1917, while in the army, following a typhoid inoculation given in his right arm, he had a severe infection. This was operated on, immediately following which he noted that he could not extend his wrist. Following this, he had nine operations for osteomyelitis and soft part infections.

Examination shows multiple scars and sinuses about elbow, with complete ankylosis of the elbow. X-ray shows complete bony ankylosis, with marked involvement of the shaft of the humerus.

These sinuses had been treated and operated on at several times and on several occasions had been entirely healed, only to break out again. A large amount of scar-tissue and infection have precluded a search for the ends of the divided musculospiral nerve, so it was decided to do a tendon transplant for the improvement of the drop wrist.

April 11, the tendon of the flexor carpi radialis was cut across at its insertion and brought around to radius through a subcutaneous tunnel and sutured with silk to the extensor longus pollicis and the extensor to the index finger. A similar procedure with the flexor carpi ulnaris and this tendon sutured to the extensors of the third, fourth and fifth fingers. Wrist was mobilized in extension for 12 days, when active motion of the fingers was started. A cockup splint is still being used.

This case was shown simply to illustrate the very early adaptation of the muscles to their new use.

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DR. ALLEN O. WHIPPLE presented a girl, aged eleven years, who was admitted to hospital, September 22, 1922, and discharged, December 24, 1922, whose chief complaint was vomiting of blood. Her childhood had been normal in every way until three years ago, when she had two attacks of vomiting of blood. No digestive disturbances. Free interval until eight months ago when she vomited blood in fairly large amount on three occasions. Another free interval from all symptoms until five days

before admission, when she had in two days five severe hemorrhages from the stomach. These hemorrhages all came on out of a clear sky without any preceding nausea, pain or other warning. She vomited up to one pint at a time, of dark blood, sometimes in clots. No pain, cramps or diarrhoea. No purpuric spots nor bleeding from mucous membranes. Gastro-intestinal series taken at the Mt. Sinai Hospital in January, 1922, showed no lesion. No habits of swallowing hair or foreign material.

Physical Examination.—Very anemic girl of eleven. Hæmoglobin 32 per cent. Spleen was palpable, soft. Wassermann negative. X-rays of chest and abdomen and gastro-intestinal series negative. No increased fragility of red cells. She was on the medical side in this hospital for several weeks, and while under observation she had several severe hemorrhages. Preceding each hemorrhage the spleen was markedly enlarged, and with each hemorrhage decreased in size. Her own physician felt that her bleeding was from varices in gastric veins, independent of the spleen, and opposed operation, but after several hemorrhages, and all conservative treatment failing, he consented to an exploratory with the request that the tributaries, namely the vasa brevia, be ligated. The attending physicians and surgeon in the hospital felt that there was some intermittent blocking of the splenic vein supply causing a recurrent hemorrhage and advised splenectomy.

Operation.—December 11, 1922, exploratory celiotomy; left rectus incision. Following pathology was noted: All tributaries to the hepatic, gastric and splenic veins were involved in a uniform dilatation and engorgement. The veins around the cardia, pylorus and gall-bladder, on the latter appearing as a collection of large varicosities on the fundus of the gall-bladder, were markedly dilated and engorged. The tributaries to the splenic vein over the spleen and left gastro-epiploic vein were particularly dilated. A very remarkable feature noted was the absence of involvement of any of the tributaries to the mesenteric veins. There was no engorgement of these veins. No evidence of fluid in the abdomen or of congestion of the intestine. Situated in the gastro-hepatic omentum directly beneath the peritoneum and apparently anterior to the common duct, was a very large vein apparently draining the tributaries from the stomach and gall-bladder. There was no thrombosis in the vein itself but it seemed to empty with difficulty into the portal fissure as if there were obstruction higher up. From the findings it seemed logical to conclude that the mesenteric vessels emptied independently and without obstruction into the portal fissure and were not connected with the splenic lymphatic veins. Splenectomy on ligation of the splenic vein with the above findings did not seem to offer a sufficient ground of relief to be carried out, although it was thought that splenectomy might take off some of the burden of the portal venous return. Ligation of the vasa brevia of the stomach was considered a hazardous and hopeless procedure. The conclusion reached was that there was some unknown obstruction to a large part of the portal circulation from the stomach, spleen and gall-bladder.

Post-operation Course.—Entirely uneventful. At no time was there vomiting or distention. On discharge on the twelfth day, spleen was just

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palpable at the costal margin on deep inspiration. Wound healed by primary union.

Follow-up.—Two months, no symptoms referable to her abdomen; no hemorrhages. Scar linear firm. Red cells 4,500,000, hæmoglobin 70 per cent.

A second case presented by Doctor Whipple, was a woman, aged thirty-six years, married, three children, housewife, who during the past four years has had attacks of dyspnœa and palpitation. During the past six months she has had frequent attacks of precordial pain with palpitation, dizziness and asthenia brought on by exertion or stress. Came to the hospital because of attack of four days of severe pain in the left upper quadrant. Examination showed heart enlarged to the right and left. All of the signs of mitral stenosis and insufficiency. Blood pressure 120/80. Spleen palpable 3 cm. below costal margin, very tender. Wassermann negative. Hæmoglobin 90 per cent. Red cells 4,900,000, white cells, 8,600, polymorphonuclears 71 per cent.

Repeated blood cultures during her stay showed no growth.

Aside from the possibility of an active endocarditis, the combination of mitral stenosis and enlarged spleen might be due, first, to mitral stenosis with auricular thrombi and embolism in the spleen; second, a healed endocarditis with residual enlarged spleen as described by Libman; third, mitral stenosis with independent perisplenitis. The second of these is the most probable. The usual associated kidney damage is not borne out by urinalysis. The spleen is easily palpable and persistently painful and tender. There have been no changes in her heart murmurs. No petechiæ have been found. Blood cultures have been negative. Temperature not elevated.

On December 2, at a time when she had been free from symptoms for several days, following an examination of her spleen she was seized with violent pain and tenderness in the spleen. The tender mass was definitely proven to be spleen by colon inflation and by X-ray. She continued to have exacerbations of pain and tenderness in her spleen, her heart condition improving, however, with rest. Following a very severe attack of pain on December 5 she insisted that an operation be performed, and on the urging of the medical attendings a splenectomy was decided upon.

January 6, 1923, a complete splenectomy was done under gas and oxygen anæsthesia, 43 minutes. Incision, left rectus. The spleen was twice the normal size. Peritoneal surface at the lower pole was studded with white granular thickenings of the subperitoneal tissue. There was no general perisplenitis. There were no thromboses of the splenic vein or its tributaries. The stomach, left kidney, colon and pancreas felt and appeared normal. The liver and bile passages were normal. Splenic vessels were not atheromatous. Hæmostasis complete. Closure without drainage. Pathological report: Chronic splenitis, perisplenitis.

On the fourth day patient developed a left lower lobar pneumonia, group IV, lasting five days. Otherwise her convalescence was smooth. She went home on the twentieth day.

Following operation patient has had no complaints referable to her splenic area. She still has symptoms of cardiac insufficiency. Following

an attack of dyspnoea and palpitation she was readmitted on February 1 to the medical side for observation.

A third case presented by Doctor Whipple was a man, aged twenty-four years, who was admitted to hospital, August 14, 1922, with recurrent jaundice, fever; pain in left upper quadrant of abdomen.

No history of nosebleeds or hæmoptysis. No hemorrhages from mucous membrane. Spleen has always been enlarged since boyhood. He was in this hospital ten years ago, at which time enlarged spleen and increased fragility of his red cells were noted. At the age of six years he had a fright at which time he had a severe attack of vomiting, weakness and fever. Since then he has always been pale and has had recurrent attacks every summer, increasing in severity with the following order of symptoms. First, fever; second, vomiting of brown material; third, jaundice; fourth, weakness. He remains in bed 3 to 5 days, up and about in 5 to 10 days. In June, 1921, he had three severe attacks. Following each attack he noticed that his scleræ were jaundiced. There was no pain associated with these attacks. In July, 1921, he was attacked with fever, malaise and marked asthenia. He was taken to the Harlem Hospital. During examination, following a palpation of his spleen, he was taken with very severe pain and subsequent tenderness in the region of the spleen. This persisted after his return to his home. In July, 1921, he was brought to the Presbyterian Hospital, at which time the spleen was found enlarged and exquisitely tender. He was definitely jaundiced. Hæmoglobin 50 per cent. Blood showed a very definite hæmolysis at 0.5 saline solution, that is fragility of his red cells was markedly increased. Stools were not clay-colored. He was given two transfusions. Pain and tenderness increased in the left costo-vertebral angle, and a *diagnosis* of perinephritic abscess was made. This was opened and about 250 c.c. of thick, yellow pus evacuated, showing a non-hæmolytic staphylococcus aureus.

Patient recovered without complications and left the hospital in two weeks. One month after leaving the hospital he developed jaundice, and this persisted for the following year until readmission to the hospital, August, 1922, when he came in for a splenectomy. Spleen was markedly enlarged at that time, going down in the inter-crystal line and extending to within 3 cm. of the umbilicus. His red blood-cells still showed a definite hæmolysis of 0.5 saline solution; hæmoglobin 51 per cent. Wassermann negative. Landsteiner amboceptor reaction negative.

Operation.—On August 14, 1922, splenectomy was performed under gas-ether anaesthesia (40 minutes) with the following findings: Liver appeared normal in size and texture. No cirrhosis; gall-bladder moderately distended but emptied easily. No stones felt in the gall-bladder or ducts. Left kidney in the region of the former perinephritic abscess palpated easily and felt normal in size and position. There were a few adhesions between the spleen and the diaphragm but none which appeared related to the previous operation. The spleen was large, measured 21 x 13 x 6 cm., weighed 720 gms., was much softer in consistency than those with Banti's disease or chronic splenitis. The

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vessels were not atheromatous. There was no collateral circulation; no ascites.

Procedures, Left Rectus Incision.—Balfour technic. Spleen removed without hemorrhage. Three rubber-dam tubes were placed in the region of the hepatic.

Pathological Report.—Splenomegaly; hæmolytic jaundice.

Post-operative course was very smooth; no complications. Red cell count showed a progressive increase, but the hæmolysis persisted and was still present two months after operation.

Five months after operation his condition was excellent. Liver was still palpable at the costal margin. Patient working at full capacity. Jaundice had entirely disappeared and he has had no recurrence of former symptoms.

DR. WILLIAM A. DOWNES referred to a case in which he removed the spleen about three years ago. The patient was a child nine years old. He had another hemorrhage one year after operation and a second one year and a half later, and the mother wrote a letter in December saying that he had died as a result of a third hemorrhage. The spleen was only moderately large. The pathological report was Banti's disease.

DR. JOHN A. HARTWELL described a similar case in which repeated hemorrhages took place and prior to each hemorrhage there was a marked engorgement of the spleen. After the hemorrhage the spleen would become much smaller, but never return to the normal size. A splenectomy was done with apparent cure, patient having been kept under observation for a considerable period. At operation it was noted that the veins were dilated very much as in Doctor Whipple's case, but not to so great a degree. The pathology of the spleen showed a splenitis only.

DOCTOR HARTWELL reported a second case with pain very similar to that in the case reported by Doctor Whipple. A very careful study of this case failed to reveal any pathology except a large freely movable spleen. The pain was severe, paroxysmal, cramp-like in character. At times there seemed to be evidence of a chronic intestinal obstruction as determined by dilated small intestine with visible peristalsis. X-ray examination failed to show any evidence of obstruction. At operation no abnormalities could be found except a large movable spleen. Its pedicle was so long that the entire organ was easily delivered from the abdomen. No evidence that it was responsible for an obstruction could be established. Largely on the advice of Professor Coryllos of Athens a splenectomy was done. It showed no pathology other than a splenitis and perisplenitis, it having been attached to the diaphragm by a few delicate adhesions. Patient made an entirely satisfactory recovery. She was relieved of all pain almost immediately and an observation extending over two months failed to reveal any recurrence of the symptoms.

DOCTOR WHIPPLE said he did not do a splenectomy because such a large area was engorged and the large veins communicating with the liver were tremendously distended as were the vessels of the lesser curvature. This

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seemed to rule out the prevention of further hemorrhage by splenectomy. In regard to the case with pain, he did not mention that the pathology of the spleen was negative except for enlargement; there were no thrombosed vessels; there was nothing to explain the symptom of pain. The speaker had hoped that he would get an explanation for this from the discussion. In looking up the literature on the subject he could find no satisfactory explanation for the cause of the pain.

RECURRENCE OF INGUINAL HERNIA AFTER OPERATIVE TREATMENT

DR. ALBERT S. MORROW read a paper with the above title, for which see page 524.

DR. FRANZ TOREK said that in his opinion faulty technic was responsible for more recurrences than any other one cause. Next in frequency comes either the failure to repair the parts concerned in direct hernia, when operating for oblique hernia, or *vice versa*, though less frequently, the failure to investigate whether an oblique sac exists when operating for direct hernia.

The speaker wished to take exception to one statement made by Doctor Morrow when he said that none of the operations devised since the time of Bassini embodied any new principle. The operation he had been practicing for the past seventeen or eighteen years, and the most recent publication of which appears in the *ANNALS OF SURGERY*, July, 1919, is based on an element in the anatomy of oblique inguinal hernia, which has theretofore been ignored, *viz.*, the fact that at the opening in the transversalis fascia which we call the internal ring the sac finds its way out, not above or below the cord, but in the midst of it, *viz.*, between the vessels and the *vas deferens*. Viewed from within, the vessels are seen to approach the internal ring from above, the *vas* from below, and these two structures meet at an angle affording the peritoneum an entering wedge to insinuate itself and to protrude forming a hernial sac. After it has found its way out, the sac may lie in any other relation to the cord, but the important thing is the relation of vessels, sac, and *vas* at the point of exit, and upon a study of this condition is based the underlying principle of Doctor Torek's operation, namely the abolition of this wedge which favors the production of a hernia. The *vas*, after having been freed from connective tissue, is placed in the lowermost angle of the internal ring, and the vessels, after a similar liberation from all adventitious tissue, is placed in the upper corner, the space between the two being obliterated by the reconstruction of the abdominal wall. Thus the original wedge-shaped arrangement is converted into a firm, square buttress. This method, if correctly performed, assures against the recurrence of an oblique hernia. The speaker considered that this method certainly did embody a new principle in the operation for inguinal hernia.

As to direct hernia, he had called attention in the same publication to the possibility of mobilizing to some slight extent the rectus muscle by separating

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the upper layer of its sheath, that formed by the aponeurosis of the external oblique, from the next layer which is derived from the internal oblique. This separation is performed at the pubic end of the muscle. The unopened rectus sheath can thus be brought into approximation with Poupart's ligament under somewhat less tension than is otherwise possible.

Some degree of tension, however, often remains in the lowest part of the plastic, for about half an inch from the pubis. In order to avoid failure due to premature absorption of sutures or to the reopening of knots, which is apt to occur when an absorbable suture, under tension, has become saturated with lymph or other body fluids, the speaker employed non-absorbable material where there was tension. This choice of material is, of course, not a new idea. Others have expressed themselves in its favor, some employing silk, others silver wire. Brandao of Rio de Janeiro, who has recently published the speaker's operation in the Portuguese language, gives preference to aluminium bronze.

There are also many details on which the speaker lays stress, but for those he referred to the published article. The operation requires a little more time and minute attention to technical details, but it offers those who are no longer fully contented with 10 per cent. of recurrences, satisfactory results with a percentage of recurrences that is almost negligible.

DR. H. H. M. LYLE said he would like to emphasize what the speaker had said about suturing without tension. In 1920, he wrote an article calling attention to the value of position in the operative treatment of inguinal hernia (S. G. O. November, 1920, p. 529).

In order to insure firm union, all tension must be avoided. Tight suturing means tissue tension, impairment of nutrition and the possibility of replacement of fibrosis. In the operative treatment of inguinal hernia this elementary procedure of placing the parts in a position of muscular rest simplifies the closure, aids union and assures comfortable convalescence. This principal was doubly important in recurrent cases.

DOCTOR LYLE said, regarding the value of Gallie operation in bad recurrent hernia, that within the last eight or nine months he had several cases in which it was necessary from a humanitarian standpoint to make an attempt to repair the hernia. These recurrences were in individuals who had been refused operation by competent surgeons and in whom the truss makers could not control the hernia. Doctor Lyle had been delighted by the results obtained by using free transplants of fascia as living sutures in the treatment of these difficult cases.

DR. J. P. HOGUET said that this question should come down to a few principles. Surgery has come to a stage where it can recognize that there should not be such a thing as recurrent inguinal hernia in children. The speaker has come to the conclusion that if a case is infected it is hopeless as far as recurrence is concerned. If there is infection there will be recurrence. The question of direct hernia is the question of pathology in the inguinal

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region, and there is no question but that enough importance has not been laid on the structure of the muscles there. Concerning this, a few broad rules can be laid down. Many direct inguinal hernias can be cured with the ordinary Bassini operation with transplantation of the cord. Those are the cases where there is a strong conjoined tendon. Second, in the case where the whole canal bulges out one will find a wide bellied rectus muscle, and that is ideal for rectus transplantation. In the third type there is a narrow, thin rectus muscle, and that the Bassini operation with suture of the reduplicated aponeurosis will cure. The speaker did not agree with Doctor Morrow that the proportion of cases that cannot be operated upon is so large. Many of them with direct hernias can be cured with any one of these operations.

DR. ALFRED S. TAYLOR said "there is something after operation which has to do with the prevention of recurrence." It was brought to his attention by Doctor Bull, who asked him to tabulate 300 cases which he (Doctor Bull) had done by the Bassini method. All these patients were operated upon by Doctor Bull, who used the same method and same suture materials in all of them. He started by keeping the patients in bed for ten days and got from 40 to 50 per cent. recurrences. He then increased the length of time in bed and there was a reverse decrease in the percentage of recurrences. When they were kept in bed for twenty-one days there were no recurrences except in cases of wound infection. He considered the time element in bed an important thing in the prevention of recurrent hernia.

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